Infinite Energy

Cold Fusion and New Energy Technology

Published by Cold Fusion Technology, Inc. Vol.3, No.15 & No.16, 1997

2nd 1997 SPECIAL DOUBLE ISSUE

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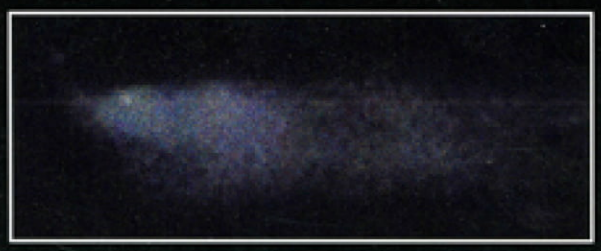

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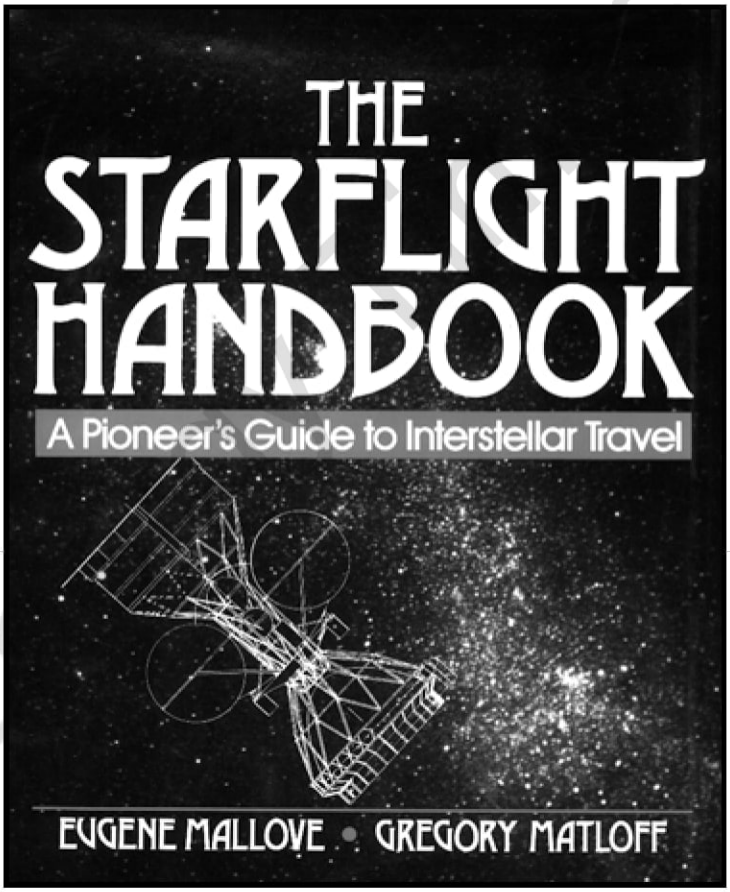

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Cold Fusion and New Energy Technology

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(Center) Stylized Cold Fusion Cell. From *Fire from Ice* cover. ***(Courtesy, E. Mallove)***

(Left) Dr. Melvin Miles at ICCF5. ***(Photo, 1995, by Gene Mallove)***

(Bottom) Glow from zirconium electrode, taken with a digital camera through transparent LENT-1 cell end wall. Flat top defining the glow indicates electrolyte level in the cell. ***(Photo, courtesy, The Cincinnati Group)***

(Right) Glowing gases within glassware in "Mass 5" or "Activated Nitrogen" experiments. See pages 123-126. ***(Photo, Courtesy Ronald J. Kovac)***

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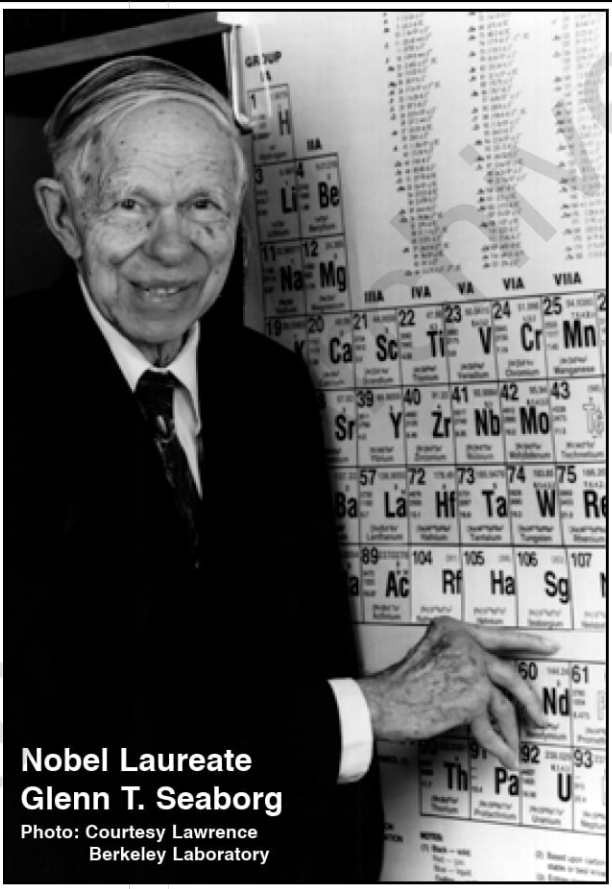

Nobel Laureate Glenn T. Seaborg
Photo: Courtesy Lawrence Berkeley Laboratory

It had only been three-weeks since March 23, 1989, when Drs. Martin Fleischmann and Stanley Pons had made their startling announcement of excess heat production and low-energy nuclear reactions at the University of Utah. Nobel laureate Glenn T. Seaborg had been called in to brief President George Bush. Days before Seaborg spoke to Bush, there had been a very enthusiastically received talk by Dr. Pons before the American Chemical Society Meeting in Dallas, Texas (April 12, 1989).

Even though the jury was certainly still out on the evidence for or against "cold fusion," Seaborg, through some as-yet-to-be-revealed process,* had determined that cold fusion was not what it was claimed to be! On April 14, 1989. Seaborg told Bush that **"it is not due to nuclear fusion."** Thus was launched a sham investigation, biased from the outset by this Nobel luminary's words to the new U.S. President. Of course, Seaborg has had ample time since 1989 to investigate the now mountainous evidence compiled for low-energy nuclear reactions and excess energy production. He has not advised any U.S. President, nor any other official to our knowledge, that the case *against* cold fusion which he helped set in motion should be re-examined. In fact, we now know from Seaborg in 1997 that he is still unrepentant and biased. We have just discovered this account of Seaborg's meeting with Bush:

[Continued, page 66]

***Had he conducted his own experiments in a mere three weeks? Certainly not! Had he talked to investigators at MIT's hot fusion lab, who had already decided that the Utah announcement was a "scam" and possibly fraud? We may never learn of Seaborg's 1989 methods.**

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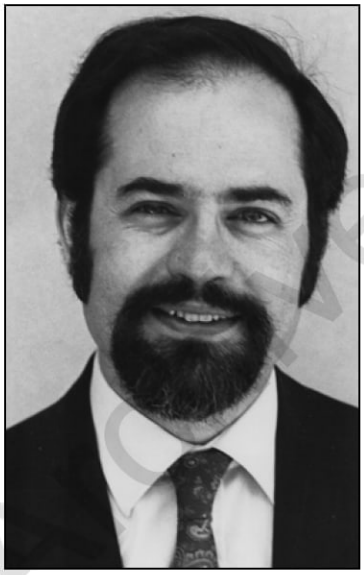
By Eugene F. Mallove, Sc.D.



Electro-Alchemy and Beyond

Alchemy is in the air. Indeed, it has been very much on the wind since the cold fusion announcement of March 23, 1989. As soon as it got out that helium might be created from hydrogen and metals in jars of water excited by tiny bits of electricity, a new kind of alchemy was unleashed on the world.

Now there is increasing evidence—there is actually *overwhelming* evidence already—of heavy element transmutations in electrochemical experiments. The question of the hour is whether alchemy has been "resurrected" or whether it never really died? Has it been alive and well in secret places around the globe—much as cold fusion itself has survived despite all the wrong-minded obituaries?

At the very least, alchemy is in ascendency as the 20th century with all its other vaunted scientific discoveries comes to an end. This alchemy revival could well be—most likely *is*—the greatest science story of the 20th century. We are tempted to call the whole shebang, "Electro-Alchemy," though that may not yet be a broad enough term (see article on page 95). Imagine this: an ancient occult art coming to life—within the framework of rigorous science—to tell us how wrong-minded we were most of this century! *Wrong* about basic scientific fact (the immutability of elements at ordinary conditions)—and using *wrong* technology to power our entire civilization.

In this century we fought wars over oil and developed horrendous conventional fission and *hot* fusion (thermonuclear) weapons. The oil barons have had a stranglehold on the planet for a century. It was all for nothing. All along, the answer to global salvation was quite literally *in the water* —hiding there, just waiting to be discovered!

There is a sense in late 1997 in which the transmutations of elements at low-energy, alchemy, and "cold fusion" (or is it "cold fission" or "cold fusion-fission"?) are coming together in one grand finale of understanding.

We must tell our loyal readers of the untimely death of our very dear colleague, Christopher Tinsley, who played such a major role in this magazine—with investigations of frontier science too numerous to mention and in stellar compositions of the English language. Those who knew Chris have managed to fill six pages of this issue with tributes to this very great man. They were all stunned by the news.

On October 1st at his home in Nottingham, England, Chris died suddenly and unexpectedly at age 54. He is survived by his children and other family members. His fianceé Susan Seddon, herself a superb writer, will carry on in a likely to be expanded role within *Infinite Energy's* "UK Office."

Though the funeral arrangements and our own recovery process delayed getting into your hands this 2nd Double Issue of 1997 (a record 128 pages!), we trust that you will regard this edition as a fitting memorial to Chris. He was a dear friend, loving father, engineer, superb writer and wit, arbitrator, renaissance man, and more. Basically, a world-class *mensch!*

There are so many developments to tell you about in these pages—we wish Chris could have lived to witness them. First, a great landmark: Dr. James Patterson of Clean Energy Technologies, Inc. (CETI) was awarded U.S. patent #5,672,259 on September 30, 1997, "System with Electrolytic Cell and Method for Producing Heat and Reducing Radioactive Material by Electrolysis." We can certainly cite this as Patent #1 of the "Electro-Alchemy Age."

Here is the abstract of this monumental achievement:

"An electrolytic cell system and method for producing excess heat for use and for deactivation [of] an actinide series metal by electrolysis in an aqueous media. The electrolytic cell includes a non-conductive housing having an inlet and an outlet and spaced apart first and second conductive grids positioned within the housing. A plurality of preferably cross linked polymer non-metallic cores each having an improved conductive exterior metallic surface formed of one or more of the actinides or daughter elements therefrom to form a bed of conductive beads are positioned within the housing in electrical contact with the first grid adjacent the inlet. The non-conductive cores are preferably sulfonated and then evaporation loaded with an actinide salt solution, dried and fired at decomposition temperature of the salt. An electric power source in the system is operably connected across the first and second grid whereby electrical current flows between the grids within the aqueous media flowing through the cell."

Even as I write this editorial, the Patterson process for transmuting radioactive actinides is being checked out at high-level places around the country. And people are already liking what they are seeing. How could they not? This is an iron-clad process—with more likely to follow—in which gram-levels of radioactive materials vanish and are fusion-fissioned to yield non-radioactive daughter products. To say the least, Physics—or is it "Fizzix," as Chris would have said—has a lot of explaining to do. THIS SHOULD NOT BE HAPPENING, period. But it *is*!

And CETI is not alone, as our loyal readers well-know. The Cincinnati Group has begun to distribute its cell kits around the world—one has already gone out to a high-profile company in Italy. The Cincinnati Group (CG) people have gone to national labs to demonstrate their patent-applied-for process and are beginning to get some positive feedback from observers after some initial setbacks due to cell leaks, etc.

In this issue we feature the preliminary report of Hal Fox and Shang-Xian Jin of Trenergy, Inc., which shows that they have replicated the CG's process many times. We look forward to more comprehensive reports from this outstanding group.

In the next issue of *IE* we will have a complete report of the cold fusion meeting in Asti, Italy, in late November, which William Collis has organized. There is so much excitement in Italy now about transmutation, that the meeting has grown larger than originally planned (see pages 83-84). In fact, Stan Gleeson of The Cincinnati Group will be demonstrating the LENT-1 transmutation cell at the Asti gathering.

For those who are skeptical that a "low tech" electrolytic approach to transmutation can work, we are proud to present the paper of Vincenzo Nassisi from the University of Lecce, Department of Physics, Laboratory of Applied Electronics in Italy (pages 119-

Continued on page 6

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122). This physicist used an excimer UV laser to create transmutations on the surface of deuterium-loaded palladium. There is much more to his paper: "Morphologic Deformation and Distribution of Generated Elements in Saturated Palladium Samples Processed by a UV Excimer Laser." Read it and enjoy! Maybe some of the laser boys at MIT and Princeton might even decide to give this a shot, eh? Or, they could just pay CG a mere $3,000 for a money-back deal on the LENT-1 electrolytic transmutation cell. Better yet, do it both ways, get positive results, and then pull the plug on the hot fusion labs there.

Of all the cold fusion researchers, Dr. Melvin Miles is among the most careful, as his monumental report on his Navy-funded work shows. Jed Rothwell has a wonderful review of the Miles work—an introduction (pages 27-34), but for those wishing to see the full details, we offer the complete report in this issue (pages 35-59). Note well that Miles has documented confirmed helium-production correlated with excess heat generation in Pons-Fleischmann-type cells. This certainly qualifies as one of the first clear indicators of the healthy birth of the Electro-Alchemy Age. Miles calculates that the probability of helium correlation with excess heat not being real is vanishingly small.

With all this low-energy transmutation work going on in the laboratory, we are forced to confront the possibility that low-energy transmutation of even base metals (such as lead or mercury) to gold is a possibility! In this issue of *IE* we have several fine historical reports from Robert Nelson of Rex Research about past claims of alchemical success (pages 97-108). Is this kind of work going on surreptitiously today and has it gone on in the past?

We aren't the only ones to wonder about this. There were some positive results for small amounts of gold production in *thermal* alchemy experiments at Texas A&M University in the Chemistry Department laboratory of Professor John O'M. Bockris in the early 1990s. This work was inspired by the creative proposals and experiments of one Joe Champion, who has now become a conspicuous figure in transmutation work around the world. Now he is based in Arizona and works with many corporations and individuals seeking to investigate the gold-making for themselves.

A sane, highly intelligent hot fusion researcher, Dr. Barry Merriman of the University of California at Los Angeles, has apparently gotten the bug. He is not sure that the results he has gotten so far represent transmutation—far from it!—but he is determined to get to the bottom of why anomalously high levels of gold—100 parts per million level and beyond—sometimes emerge from systems with simple chemical additions to ostensibly (*and tested by Barry to be so!*) highly pure lead. The non-regular repeatability of these experiments is acknowledged by Dr. Merriman, but he has not given up! In fact, he is working very closely with Joe Champion not only on these table-top thermal experiments, but also investigating what Joe claims are commercial-level operations producing of gold from lead at sites from Nevada to Texas. [Please! Do not ask us for the "recipes," they are still confidential—under non-disclosure!]

All this gold-making investigation—by a hot fusioneer no less!—leaves we mere cold fusioneers seeking a solution to the world's energy problems somewhat breathless. Aw shucks, we'll admit it. We bought the equipment and are going to check out these thermal alchemy processes ourselves. Work has already begun. We are only beginners at this kind of metallurgical analysis with electric kiln and bone-ash cupels that suck up lead oxides (but

Continued on page 12

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LETTERS TO THE EDITOR

If I had the money, I'd bankroll cold fusion research in a heartbeat. Thank you for enlightening me on this subject. I was with those who dismissed cold fusion as "bad science" back in 1989. I feel chagrined to have followed the wrong path in science's perpetual cycle of problem-> discovery-> revolution-> rejection-> acceptance. I can see the future— if I only had the money to help in getting there...

Paul F. Williams

Thank you Paul! Even though you don't have "Big Bucks" to help the field, at least you have come in from the cold. Spread the word!—EFM

• — • — •

What is the DOE's position on Cold fusion? The Dept. of Energy (DOE) is tasked with creating high level nuclear waste (fission byproduct) disposal site. Yet, the DOE is currently facing a class action suit from a cooperation of commercial nuclear companies and others for the DOE's admission that they don't even have a plan for high level waste storage site completion. It is also apparent that the NRC has been given the mandate for a step change in policy to "raise the bar" of acceptance of commercial nuclear plants and to not hesitate to close them down. I can't help but wonder, what if any impact does the emergence of possible cold fusion and radioactive waste transmutation has on their fission related policy decisions (not even having a plan for high level waste storage "Yucca mountain" facility completion). I'm concerned that premature abandoning of commercial nuclear power may create a gap in viable available energy which could lead to economic instability while we are waiting for commercial cold fusion, or whatever else, to mature. In the Northeast U.S. region alone, currently several nuclear plants (perhaps 7-8 gigawatts worth) have already or are soon to be decommissioning (Yankee Rowe, Conn., Yankee, Maine, Yankee, Milestone Units 1,2 and 3, Vermont Yankee by year 2000, several Canadian plants including Point LeProe also).

Is anyone at DOE or elsewhere monitoring the rate of commercial nuclear plant decommissioning in comparison to alternative "Base Load" energy commercialization? Am I naive, or will there be a gap in online commercial energy technologies in the next twenty years of transition (i.e. "during the death of commercial nuclear fission utilities")? How do you see this era of transition? Perhaps the "revolutionizing of energy" and "solving the world's energies needs" will involve an equally profound side-affect, "growing pains." My point is, that equally important to the pursuit of alternative energy is the pursuit of a transition plan that will minimize the "growing pains." Are there any such transition plans being pursued at a sufficient scale given that many government bodies deny (at least in public policy) the existence of greater than unity energy conversion? I welcome your insights.

Brent Moulton

Brent, your thinking is way ahead of governments. There total denial by governments of the emerging cold fusion/new energy revolution. In my view, transition plans are of minimal importance compared to the imperative of igniting a New Energy Revolution consciousness. The only "transition plans" you will find are published in these pages. Contributing Editor Jed Rothwell is the foremost thinker on this subject. Check out his essays.—EFM

• — • — •

Dear Dr. Mallove:

Thanks for your recent letter with a reprint from the cover story of TWA's *Ambassador* magazine [***The September 1997 issue had a profile of Eugene Mallove's cold fusion quest.—EFM]***, and a copy of the press release on the NHE program. It is particularly important to know this information when the shock wave may come from various directions.

With the experimental data in hand and the idea of "selective resonant tunneling," I feel more confident than at any time before. I am working hard to do more experiments to clear some uncertainties. I believe that we are climbing the Pisa Tower while someone is calling, "Aristotle has reached the conclusion already!"

Best wishes,
Li, Xing Zhong
Beijing, China

We will probably reprint the Ambassador article in a future issue of Infinite Energy*—EFM*

• — • — •

Triumph for Zero Point Energy/Aether—

I came across this article in *The New York Times* today that might be of interest to your staff: "Scientists Use Light to Create Particles" —*New York Times, Science Times* 9/16/1997 pg.[F5]

The article states that a group at Stanford's SLAC has confirmed the theories of Breit/Wheeler and Julian Schwinger for creating matter out of a collapsing vacuum state via an ultrastrong electromagnetic field. By phase-locking a trillion-watt green laser with a counter-current pulsed electron beam from the SLAC accelerator, the group created an electron and a positron.

Unfortunately, the spokesman for the group, Dr. Melissinos from the University of Rochester, said that "The experiment, ..., is unlikely to have any practical applications.." Hmm... I guess he doesn't read *Infinite Energy*.

I hope this info is useful to you. I am glad that there is a scientific publication that still adheres to the true tenets of science—wonder and exploration.

Frank Bolander
Sunyata Multimedia

P.S. -- Sunyata stands for the "seamless void from which everything is created" in Buddhism.

Thank you, Frank. We had seen the information. It is interesting how Dr. Melissino's comment's echo the negativity of Ernest Rutherford in the 1930s who denied that nuclear energy of any form would ever be

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practical. Such blindness to new possibilities is even more prevalent today.—EFM

• — • — •

I am a high school student in Waterloo, Iowa. My name is Justin. A few weeks ago I started a project for a class called ELP (Expanded Learning Program). You create your own projects and are encouraged to learn about what you want. I choose alternative energy. Originally I thought that most of the info. I would be interested in would be on solar and wind energy. However I stumbled upon cold fusion quite by accident while looking around the web.

Until recently I thought cold fusion was no more than a pipe dream at best. However, after a few days of intensive research on the Web and at the local library it appears VERY much different. At this point in time I am interested at learning anything and everything about cold fusion. My thirst for knowledge on this subject is VERY unsatisfied at this point in time. Mr. Mallove, I have your 1991 book on order at the moment and hope to get it in a few days. I have also read most of the information at your web site, Mr. Rothwell. I want to learn more if possible.

I was just wondering if either or both of you could point me toward some resources (books, magazines, web sites, people, anything) to learn more about cold fusion and recent developments in the field. I have no specific area in this field that I want to learn about, I want to learn about it all. I want to learn about the skeptics, who is funding it, what advances have been made, where cold fusion is headed in the future, what current theories are on how it works, what attempts at commercialization are being made, and, in short, everything.

PLEASE, if you can point me to any resources I really would appreciate it. Thank you so much for your time and I look forward to your response soon!!

VERY curious,
Justin

Justin, it is always a fantastic relief to see that eager young minds are being turned on to a reality that was given up for dead by the hit-and-run con-artists against cold fusion of 1989 and later. We will provide you with whatever information you need to carry out your projects. Bless you!—EFM

• — • — •

Congratulations on the special double issue of *Infinite Energy*, No. 13 & No.14. I spent a lot of time studying it. I found Peter Graneau's article reviewing the work done with water arc explosions especially interesting, because it's the first article I've read anywhere about those spectacular and puzzling experimental results.

Your magazine deserves to be read by more people. Good luck in increasing its circulation.

Tom Stolper
Connecticut

Tom, with any luck, we may soon "go exponential"—once those prototype products are circulating out there. We can't wait!—EFM

• — • — •

Posting by Robert G. Flower to Vortex forum (8/30/97):

Vigier says "tight orbitals" can yield "excess energy"

Here is some good news to offset the bad news about Japan's shutdown of the MITI—NHE program. *[Editor's Note: See our coverage on NHE politics in this issue.]*

I just returned from the "Vigier II" symposium at York University in Toronto [Ref. 1].

On Tuesday (26 August), Jean-Pierre Vigier gave a talk [Ref. 2] which outlined new developments in electromagnetic theory which predict the possibility of obtaining "excess energy" by inducing electrons in H2+ and D2+ atoms to fall into "tightly bound states" below the first conventional Bohr orbit.

As I understand it, Vigier's proposal (originally given at ICCF 4 [Ref. 3]) is this: by treating the electron as a real spatially-extended charge distribution within the deBroglie-Bohm Quantum Potential formalism, and by taking into account the coupling between spin-spin and spin-orbit magnetic moments of an atom within an applied magnetic field, one can predict that "soft X-rays" on the order of several thousand electron-volts per atom will be produced.

Conventional quantum mechanics (eg, the Copenhagen interpretation of Bohr) fails to see this possibility because it assumes that electron spin orientations are totally random, says Vigier.

Quote from Ref. 2:

"These new EM interactions lead to possible interpretations of recent exothermic electrolytic and plasma discharge experiments, and predict new chemical bonds and new nuclear phenomena in dense media under the influence of real short range magnetic interactions."

Vigier's paper cites a few recent publications [Refs. 4 to 6], and he also mentioned the work of George Miley at Chicago and Mike McKubre at SRI.

In discussion, Vigier said that if "excess heat" is generated in Pons-Fleischmann type Cold Fusion experiments (ie, a metal lattice loaded with D_2 or H_2), its source would not be nuclear fusion but rather the collapse of electrons into "tight orbits" as predicted by his theory. He also said that the French Atomic Energy Authority (eg, Biberian et. al.) and "Shell" are sponsoring major work in France to study this possibility.

It's worth noting (though it proves nothing scientifically) that Vigier is an eminent scientist (age 77) whose long career included work with Louis deBroglie and David Bohm, among others. He is currently an editor of *Physics Letters A*, published in Europe.

[1]. "Causality and Locality in Modern Physics and Astronomy: Open Questions and Possible Solutions. A Symposium to Honour Jean-Pierre Vigier." August 25-29, 1997, York University.
Website at URL: http://turing.sci.yorku.ca/VigierII/

[2] "Possible Consequences of an Extended Charged Particle Model in Electromagnetic Theory," by J.-P. Vigier. Presentation 26 August 1997 at Ref. 1.

[3] J.P. Vigier. "New Hydrogen (Deuterium) Bohr Orbits in Quantum Chemistry and 'Cold Fusion' Processes." *ICCF4 Proceedings*. Hawaii (1993).

[4] N.V. Samsonenko, D.V. Tahi, and F. Ndahayo. "On the Barut-Vigier Model of the Hydrogen Atom." *Physics Letters A* 220 (1996) 297.

[5] A.O. Barut. "Prediction of New Tightly-Bound States of H2+ (D2+) and 'Cold Fusion' Experiments". Colorado University Preprint (1995).

[6] J.P. Vigier. *Physics Letters A*. 211 (1996) 138.

Robert G. Flower
Applied Science Associates
- Custom Software Development
- Quality Control Engineering

• — • — •

Greetings Doc,

My name is Joe Esposito and I am interested in cold fusion and the possibilities of endless clean power. I am not a college graduate or in any way formally trained in science. Most of my science background comes from watching the discovery channel and reading books.

My trade is patternmaking and machining. During work I daydream about space, math, and science. During one of these daydream sessions, I thought to my self, "I wonder if cold fusion happens in the human body."

So my question to you is, if the body uses watter, vitamins, minerals, and small amounts of electricity, what are the possibilities of our body creating cold fusion?

I hope you do respond to my question and disregard my spelling.

Scientifically yours,
Joseph Esposito

Marvelous thoughts coming from your daydreams! Yes, we are increasingly hearing about researchers who find biological systems—bacteria, plants, and higher organisms— apparently creating nuclear transmutations. This area definitely merits watching. We have covered it already in issue #10. More coverage of theory and experiments in biological transmutation is on the way.—EFM

• — • — •

Dear Dr Mallove,

As I had mentioned to you in my previous e-mail, following a small correction for my e-mail address, I was going to send you an update on Stefan Marinov's death.

New Energy Times Archive

Here it is:

Update on Stefan's Marinov death.

On 18 to 20 of August, I and Dr Paul LaViolette visited the city of Graz to investigate the accident. We visited the University of Graz at the back of the Bibliotheque at Universitatsplatz 2, A 8010- Graz, where Stefan Marinov presumably jumped off from the top of the four level outside emergency staircase to the street. According to the librarian only one student show Stefan actually jumping off. The name of the student is not known to us. The body of Stefan was found lying on the street below the staircase by Professor Ernst Ebermann. Stefan was not bleeding and initially Professor Ebermann thought he was sleeping there. He was still alive. Stefan left no cry or cries. The ambulance was called and Stefan died on his way to the Hospital. The cycle with which Stefan presumably arrived there, is still there, locked and unnoticed (still today 19/9/1997). Nobody else noticed the accident, except first the assumed student and later Professor Eberman 031 36 61637, 0316-380 5605, fax 0316-381255, and perhaps a few other people later.

According to Professor Eberman, a brightly visible fluorescent spot, about the same size and in the same exact position with the body, was left on the asphalt of the street, for 3 days, after the removal of the body, without an apparent cause for the spot, or without being due to any bleeding of blood or another liquid coming from Stefan's body.

The Police has made no official announcement today. Apparently, they did not investigate the case obviously in depth, since the bike is still by the place of accident, locked and unnoticed. The apartment of Stefan is sealed by the police and nobody is allowed to enter, except for his son Marin Marinov who entered for a brief time on 6 or 7 of August 1997. His belongings were not allowed to be taken and are still sealed there.

Stefan left various letters typed over his type writer and bearing his signature. In a particular letter, he was asking me to be notified immediately and a few others. The police never made the notification to anybody.

The authorities of Graz refuse any value for the letters and to his last will, for it bears only one signature without witnesses. The case of Stefan Marinov and his letters were given to the city Advocate: Dr Egbert Sprenger, Joanneuming 11, A-8010 Graz, tel: +43-316 828991-0.

In the morning of 19/8/1997, we, together with Mr Jeorg Deisting fax/phone +43-316-464023 visited the offices of the city advocate Dr E. Sprenger. The said case and letters were there, but, we were refused of any information. We strongly protested against the refusal, but, eventually, we had to leave without getting any information.

The son of Stefan Marinov, Marin Marinov (+359 88 520840, +359 2 988 5246, fax +359 2 988 52 84, zamminister@online.bg) is currently Deputy Minister of Industry of Bulgaria and is in a delicate situation with respect to the death of his father.

No one knew or was told about the intended and assumed suicide of Stefan Marinov, even his brother who talked to him on the phone one hour before Stefan's death. Stefan had visited his son in Bulgaria 20 days before, myself in Athens 15 days before, had written a letter to me 3 days before, and had written letters to various other people, making appointments or suggesting various future collaborations (to Professor Selleri for example). 10 days before Stefan's death, Stefan had made a Hotel reservation for me and himself for an International Physics Conference to take place in Koln, Germany, on August 25, 1997.

Professor P. T. Pappas,
Markopulioti 28, Athens 11744, Greece.
e-mail pappasp@ibm.net
tel: ++301-9010355, fax: ++301-9011620.

Thank you for providing further details of your investigation.—EFM

• — • — •

I heard you talk on Cold Fusion on the Art Bell radio program and even though I know these things are coming about, I'm not a scientist, but have studied Nikola Tesla's works. So I am familiar with what you talked about.

My grandson is studying to be an environmentalist. I'm sure he would be interested in this Cold Fusion and maybe he knows about it, but they have discouraged it. I'm sure if you have any literature or would be willing to send it to me, I will pass it on to him.

This is a young people's world now and some are so awake and ready to find answers. I give you great credit for your work along with the others.

Dorothy Sweitzer
Hartville, Ohio

Dorothy, this is not only a "young people's world," it is for the older but young at heart too—like yourself—people within whom the dream of the New Energy Age lives!—EFM

• — • — •

How refreshing it was to pick up a copy of your *Infinite Energy* magazine issue 2/11 recently, and strictly by accident as I had no idea you existed! Being a believer in alternative energy sources, especially hydrogen based, it was very exciting to read through the articles. Being an industrial electrical technician, I especially loved the article on the Adams motor.

Enclosed is a check for the video: "Free Energy-The Race to Zero Point," which was advertised on the back cover of your magazine. I can hardly wait to see it.

Fred Sherwood
Bridgeport, Connecticut

In a forthcoming issue, we will have test results from one of our readers who built an Adams motor.—EFM

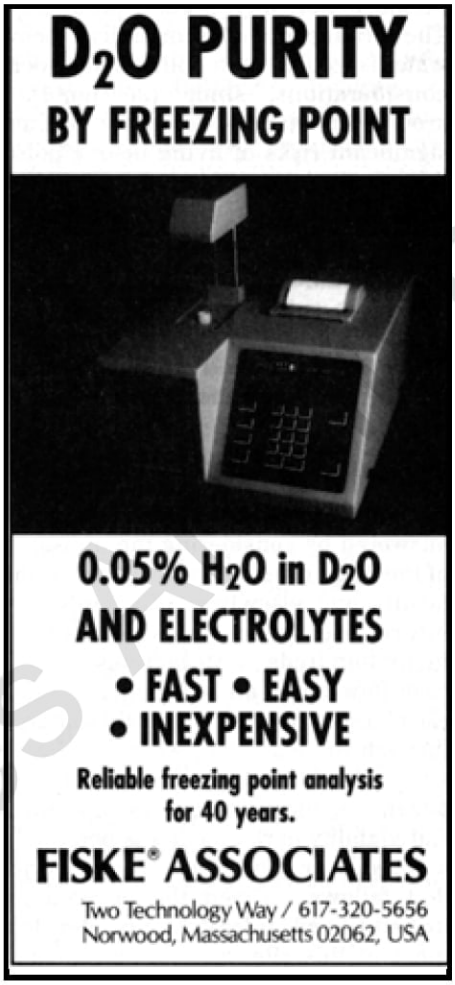
• — • — •

Your article in the July/August issue of Analog was a real eye-opener. Thank you for your no-holds-barred presentation.

I share your feelings about those who lack vision, yet are in a position to frustrate and hold back those who are trying to "get on with it." I am not a physicist or engineer, but have a general scientific background and spent my career (when not flying with the Air Force) as a technical consultant in electronics to the armed forces. Perhaps you heard of "Philco Tech-Reps"—I was one of them for ten years, then accepted a Civil Service position with the U.S. Army, doing the same thing from within. And I had my share of "know-it-all" bureaucrats. Fortunately they were never my immediate superiors, who were always happily supportive.

It is amazing to learn so much has been

LETTERS Continued on Pages 54-59



New Energy Partners Investment Fund to Start in December

In November, ***Infinite Energy*** received the following news release:

Press Release

Contact: Daniel J. Cavicchio, Jr.
Phone: 203-629-4447 Fax. 203-629-4848

FOR IMMEDIATE RELEASE:

NEW ENERGY PARTNERS TO LAUNCH INVESTMENT FUND

New Energy Partners, a Connecticut Limited Partnership, is about to launch an investment fund that will invest in leading edge companies developing revolutionary new energy technologies. Some of the companies and technologies that the Fund will investigate have been previously reviewed by *Infinite Energy* magazine. (The Fund was previously discussed in the special double issue, No. 13 & 14, in 1997.)

Dr. Daniel J. Cavicchio, Jr., who is the Chief Executive of Energy Horizons, LLC, announced that Energy Horizons will serve as the General Partner of the Fund. Energy Horizons was established specifically to manage the Fund and will be responsible for managing the entire investment process as well as providing business consulting and assistance to the extent needed to the portfolio companies.

Dan Cavicchio expressed enthusiasm about kicking off the Fund. "Up until now the Fund was just a concept that we were floating to determine interest on the part of accredited investors. I am now pleased to say that we have attracted enough investment interest, aided by a lead investor, who has committed up to $1 million, to now get the Fund launched and to have a first closing. A Private Placement Memorandum has been drafted that will enable us to be in business by early December 1997.

Cavicchio went on to say, "We have already begun due diligence investigations of a few companies and are very pleased with what we are seeing. Our discussions with these companies are covered by non-disclosure agreements, so we cannot reveal details in a public forum. However, we can say that we are witnessing a wide-variety of devices that demonstrate very high 'over unity,' effects and producing high energy outputs over a sustainable period of time. Many of these clearly look like the predecessors to commercial products."

The Fund will stay open to new investors until a goal of $10 million to $15 million has been achieved. "We don't know whether it will take a few months or longer. We have been in conversation with a few very large investors who have indicated the possibility of fully funding the remainder of the goal. If that happens, we will close the Fund to any additional investors and focus entirely on the investment process."

New Energy Partners will invest in companies that are developing new energy technologies or other products/processes that stem from these technologies, such as nuclear transmutation. Generally, it will focus on technologies that are environmentally clean and have the potential to gain a significant market share of the worldwide energy industry. These will generally be technologies that could produce energy efficiencies and energy densities well in excess of those currently experienced by burning fossil fuels. The fuel cost associated with these technologies should show promise to be a small fraction of the cost of fossil fuels.

One class of technology that will receive particular attention involve fuel cells that utilize hydrogen in conjunction with certain metals to produce energy outputs well in excess of the excitation energy required to initiate and sustain the reactions. These technologies have been demonstrated by a number of companies. Many theories exist regarding the type of reaction that may be taking place, including chemically activated nuclear reactions, water energy, cold fusion, slow fission, and collapsing hydrogen atoms. Although these theories are often important to facilitate efficient research and development, the Fund's primary concern will be to ensure that the inventions work, and that there is a high likelihood that the inventions can be converted into commercial products within the life of the Partnership. In addition, certain of these technologies show promise for deactivating radioactive materials through a process called transmutation.

The market for these technologies is the entire worldwide energy industry, which is measured in the trillions of dollars. Accordingly, we expect that successful companies in this field will provide very large investment returns to their shareholders. Applications will include heating of buildings, heating of hot water, local low-cost production of electricity for homes, factories, and commercial buildings as well as eventually powering automobiles. Because many of these technologies will be environmentally clean and highly efficient, it is expected that they will make major inroads into the conventional energy technologies that are currently in use. Eventually, they will also play a major role in cleaning up the environment.

Dr. Cavicchio's background was profiled in detail in the double issue #13 & #14 of *Infinite Energy*. In summary, he holds four technical degrees from Rensselaer Polytechnic Institute and the University of Michigan. He has worked with the Aerospace Corporation, McKinsey and Company, American Can Company, and, most recently, Greenwich Venture Partners, Inc. As a co-founder of Greenwich Venture Partners, Inc., he specialized in turning around technology-based companies that he and his partner purchased with their own funds.

In order to comply with exemptions from Security Laws, the Fund is available only to "Accredited Investors." Although there are a number of criteria to determine an accredited investor, for an individual it typically would include a person whose net worth (including real estate, personal property, etc.) exceeds $1- million, or a person who has sustainable income in excess of $200,000 (or $300,000 jointly with the person's spouse).

Parties interested in receiving the Private Placement Memorandum should contact Daniel J. Cavicchio, Jr., New Energy Partners, 8 Sound Shore Drive, Suite 100, Greenwich, CT 06830, Telephone: 203-629-4447, Fax: 203-629-4848.

This article and the information contained herein does not constitute an offer or solicitation of investment. A formal offer can only be made through the Private Placement Memorandum and the supporting documents. Although the information contained in this article in from sources considered to be reliable, the prospective reader in cautioned that there is no representation as to the completeness or accuracy of the information.

-END-

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A *must read* book—Order your copy today from Cold Fusion Technology, Inc. !

Newton versus Einstein, by Peter Graneau and Neal Graneau. Carlton Press, 1993 Hardcover. 219 pages, $14.95. ISBN 0-8062-4514-X

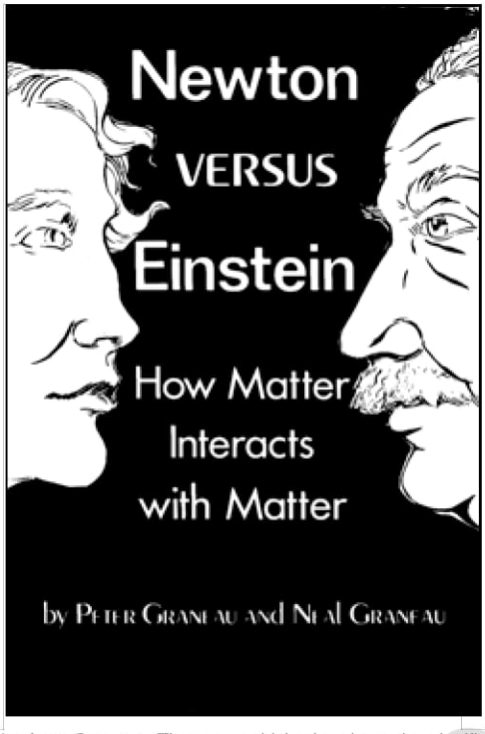
NEW TECHNOLOGY!

NEWTON versus EINSTEIN is not merely a critique of contemporary physics. Nor is it just an outline of the clash of philosophies. It points the way to new technologies from space accelerators to high-current switches and improved metal refining. Most exciting is the discovery of how to gain solar energy from ordinary water via the release of intermolecular bonding energy, as recently explained in *Infinite Energy* (Issue #10) and featured in a forthcoming BBC-TV program. It could become as important as the discovery of nuclear energy, yet be benign to man.

Praise for Newton versus Einstein

Inertia is a much-discussed topic. The Graneaus give a beautiful account in which they relate theories of inertia back to those of Mach at the beginning of the century. They view inertia as the result of the gravitational interaction of all particles in the universe on the body in question, instantaneous transfer making even distant galaxies a part of the interaction .

The authors feel, correctly, that there is a resemblance between the Academies of Science at present and the influence of the Church at the time of Galileo. There is effective censorship of ideas inconsistent with



the I926 Quantum Theory or which play down the significance of Relativity. If new observations do not agree with the present physics, the investigator is accused of fraud or sloppy science....

But now, the authors believe, the dust has settled and there are too many aspects of present physics that seem inconsistent with observation. The time has come for a Great Re-Think. There is a telling quotation from Einstein in a letter written towards the end of his life to his old friend Besso. It states that field concepts may be entirely wrong. If they are, Einstein says, then all his endeavors and the rest of modern physics are up for re-forming.

This little book is the expression of workers who really do try to penetrate into the darkness, instead of singing the old song in a new style. But scientists like the Graneaus will never win the Nobel Prize. They ask too many disturbing questions to obtain the support of the establishment scientists who decide who gets the Prize.

Professor John O'M. Bockris,

JOURNAL OF SCIENTIFIC EXPLORATION, Spring 1995

ABOUT THE AUTHORS

Peter Graneau is well known for a long series of experiments in classical electrodynamics performed during thirty-five years in university and industrial laboratories on both sides of the Atlantic. The results he obtained were consistent with the old Newtonian electrodynamics which flourished in Europe during the nineteenth century. Dr. Graneau has published his findings in more than forty papers in prestigious physics and engineering journals and in his 1985 book *Ampere-Neumann Electrodynamics of Metals*. Some of his work has been sponsored by the U.S. National Science Foundation, which commended him for his efforts. The Graneaus make their home in the town of Concord, Massachusetts. They love nature, and they walk and canoe where Henry David Thoreau lived. In this beautiful area, Peter Graneau has time to contemplate the course physics may take in the next century.

Neal Graneau was born in London, England, and attended Fenn School in Concord, Phillips Exeter Academy in New Hampshire, and Winchester College in England. He traveled with school theater and poetry groups, and played piano recitals. Neal Graneau studied physics at King's College of London University, and at Oxford University as a graduate student. He is currently a full-time researcher at Oxford. For ten years, he spent his summers in his father's MIT laboratory. There this father-and-son team researched, invented, built and performed the experiments described in this book. When not at work, Neal finds time to relax by playing the drums in an Oxford group.

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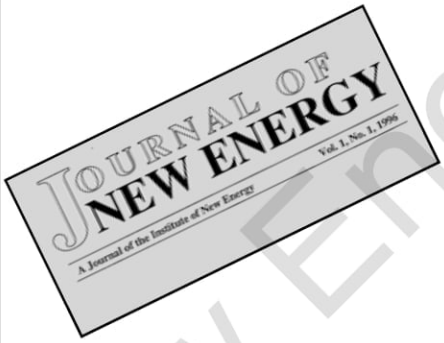
"Breaking Through" continued from p.6

not precious metals), but we are determined to try to resolve the question once and for all—if Barry doesn't beat us to it. For our part, we'd much rather see free energy than cheap gold and other precious metals—energy is far more important to the well-being of humanity. Furthermore, precious metals such as platinum and palladium are certain to play some role in the electrochemical excess energy systems, though obviously nickel-based, lower materials cost systems might be preferred. But what if platinum could be made cheaply?

We are sure that even cheap gold would not become free gold, because gold has so many uses in anti-corrosion resistance, electric conductors, etc. Think of it! Gold-plated cars and gold-plated bridges! (Literally, "The Golden Gate Bridge.") Still, we wonder how this thermal alchemy—*if it is real at all*—might possibly fit within the context of new physical theories to explain Electro-Alchemy or "cold fusion." That is what is most important. But we could not resist asking economist Charles Barr for his assessment of what the economic consequences of "Gold Fusion" might be (page 96).

Speaking of financial matters, we are happy to tell you that the *New Energy Partners* investment fund has been launched formally. Read about it, take action, and grow rich in spirit and substance. And don't forget to help yourself while helping the world by giving holiday gifts of *Infinite Energy* subscriptions. Bless you all!



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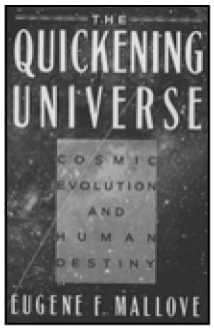

1987, St. Martin's Press, hard cover, 268 pages, illustrated by the author.

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MAJOR DEVELOPMENT: U.S. Patent on Low-Energy Transmutation by Electrolysis Granted to Dr. James Patterson.....

United States Patent Patterson
Patent Number: 5,672,259
Date of Patent: Sep. 30, 1997

SYSTEM WITH ELECTROLYTIC CELL AND METHOD FOR PRODUCING HEAT AND REDUCING RADIOACTIVITY OF A RADIOACTIVE MATERIAL BY ELECTROLYSIS

Inventor: James A. Patterson, 2074 20th St.. Sarasota. Fla. 34234

Appl. No.: 653,194
Filed: May 24, 1996

Int. Cl.[6].....C25B 900; C25B 15/08
U.S. Cl. .....205/43; 205/44; 205/687; 205/769; 205/758; 204/275; 204/284; 204/290 R
Field of Search.....204/275. 284, 204/290 R; 205/68.7, 758, 769, 43, 44; 376/100, 146

References Cited

U.S. PATENT DOCUMENTS

4,316,786 2/1982 Yu et al.....204/275 X
5,318,675 6/1994 Patterson.....204/275 X
5,372,688 12/1994 Patterson.....204/275 X
5,607,563 3/1997 Patterson.....204/269

Primary Examiner— Donald R. Valentine
Attorney, Agent, or Firm— Charles J. Prescott

ABSTRACT

An electrolytic cell system and method for producing excess heat for use and for deactivation [of] an actinide series metal by electrolysis in an aqueous media. The electrolytic cell includes a non-conductive housing having an inlet and an outlet and spaced apart first and second conductive grids positioned within the housing. A plurality of preferably cross linked polymer non-metallic cores each having an improved conductive exterior metallic surface formed of one or more of the actinides or daughter elements therefrom to form a bed of conductive beads are positioned within the housing in electrical contact with the first grid adjacent the inlet. The non-conductive cores are preferably sulfonated and then evaporation loaded with an actinide salt solution, dried and fired at decomposition temperature of the salt. An electric power source in the system is operably connected across the first and second grid whereby electrical current flows between the grids within the aqueous media flowing through the cell.

18 Claims, 1 Drawing Sheet

SYSTEM WITH ELECTROLYTIC CELL AND METHOD FOR PRODUCING HEAT AND REDUCING RADIOACTIVITY OF A RADIOACTIVE MATERIAL BY ELECTROLYSIS

BACKGROUND OF THE INVENTION

1. Scope of Invention

This invention relates generally to electrolytic cells, and more particularly to an electrolytic cell and system for producing excess heat and for deactivating radioactive metals of the actinide from the group consisting of actinium, thorium, protactinium, uranium, neptunium, plutonium, americium, curium, berkelium, californium, einsteinium, fermium, mendelevium, and lawrencium series of metals by electrolysis.

2. Prior Art

The utilization of palladium coated microspheres or beads as a catalytic agent for the absorption of hydrogen is taught in prior U.S. Pat. Nos. 4,948,355 ('355) and 5,086,031 ('031). In these patents, the utilization of cross linked polymer microspheres forming an inner core and having a coating of palladium and other halide forming metals thereatop exhibit significant improvements in the level of hydrogen absorption and the absorption of isotopes of hydrogen.

Utilizing these catalytic microspheres led to the invention disclosed in U.S. Pat. Nos. 5,318,675 ('675) and 5,372,688 ('688) which teach an electrolytic cell, system and method for, inter alia, producing excess heat within a liquid electrolyte.

More recently. U.S. Pat. No. 5,494,559 ('559) discloses an improvement in the layer structure of the catalytic microspheres or beads within an electrolytic cell. The combination of nickel/palladium layers enhance the production of excess heat within the liquid electrolyte.

In each of these prior '675, '688 and '559 U.S. patents, the electrolytic cell described therein included an inlet and an outlet facilitating the flow of the liquid electrolyte therethrough. Thus, as the liquid electrolyte is passed through the electrolytic cell, it is acted upon catalytically by the particular bed of catalytic particles contained within the housing of the electrolytic cell to produce excess heat for use.

The present invention improves upon the structure and composition of the catalytic particles which make up the active particle bed within the electrolytic cell through the utilization of non-metallic cores having a metallic surface formed of one or more elements taken from the actinide series or daughter elements derived therefrom.

BRIEF SUMMARY OF THE INVENTION

This invention is directed to an electrolytic cell, system and method for producing excess heat for use and for deactivation actinide series metals by electrolysis in an aqueous media. The electrolytic cell includes a nonconductive housing

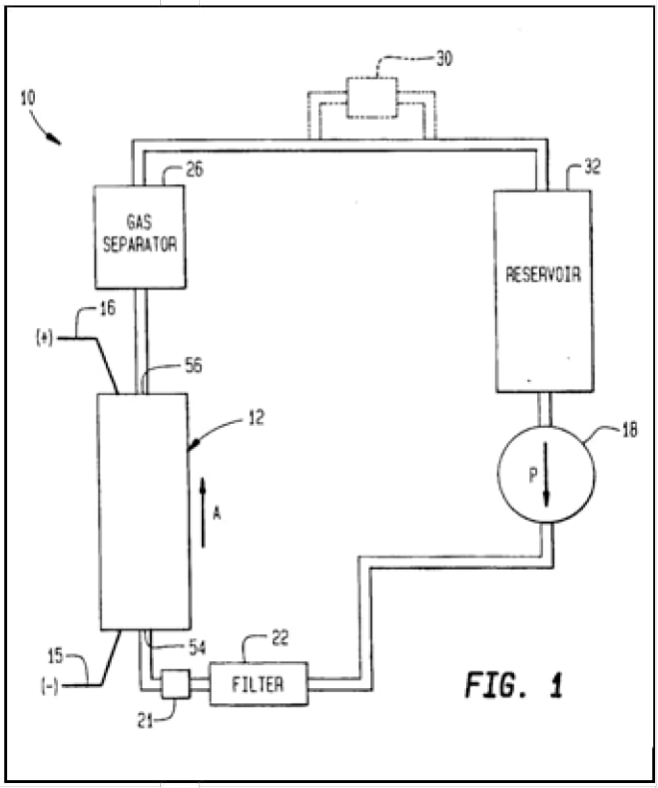

FIG. 1

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having an inlet and an outlet and spaced apart first and second conductive grids positioned within the housing. A plurality of preferably cross linked polymer non-metallic cores each having an improved conductive exterior metallic surface formed of one or more of the actinides or daughter elements derived therefrom to form a bed of conductive beads are positioned within the housing in electrical contact with the first grid adjacent the inlet. The non-conductive cores are preferably sulfonated and then evaporation loaded with an actinide salt solution, dried and fired at substantially decomposition temperature of the salt. An electric power source in the system is operably connected across the first and second grids whereby electrical current flows between the grids within the aqueous media flowing through the cell.

It is therefore an object of this invention to provide an improved electrolytic cell and system for producing excess heat.

It is yet another object of this invention to provide an improved electrolytic cell, system and method for producing excess heat for use and for deactivating radioactive materials by electrolysis in an aqueous media.

It is still another object of this invention to provide a method of preparing catalytic beads for use in an electrolytic s cell, system and method for producing excess heat for use and for deactivating radioactive material within the actinide metal series and daughter elements derived therefrom.

In accordance with these and other objects which will become apparent hereinafter, the instant invention will now be described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of a system and electrolytic cell embodying the present invention.

FIG. 2 is a section view of the electrolytic cell shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, a system embodying concepts of the invention utilized during testing procedures is shown generally at numeral 10. This system 10 includes an electrolytic cell shown generally at numeral 12 interconnected at each end with a closed loop electrolyte circulation system. The circulation system includes a constant volume pump 18

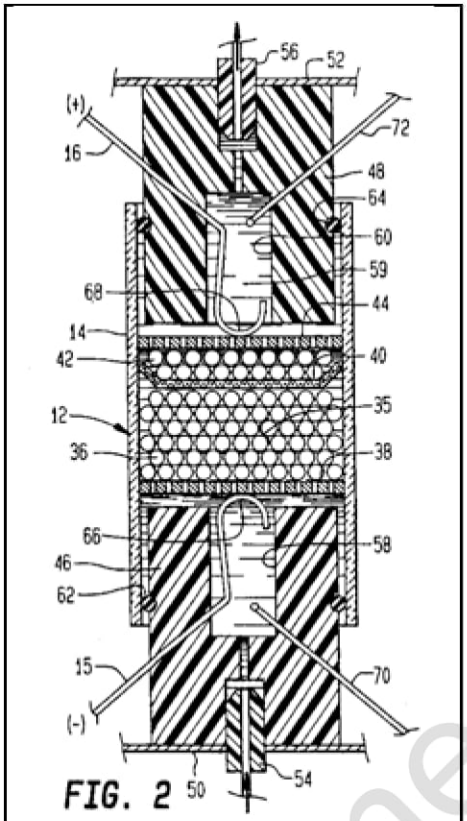

FIG. 2

which draws a liquid electrolyte 59 from a reservoir 32 and forces the electrolyte 59 in the direction of the arrow into inlet 54 of electrolytic cell 12. After the electrolytic cell 12 is completely filled with the electrolyte 59, the electrolyte then exits an outlet 56, thereafter flows into a gas separator 26 which is provided to separate and recombine hydrogen and oxygen gas from the electrolyte 59.

An in-line filter 22 capable of filtering down to 1.2 microns of particle size is provided for filtration of debris within the system.

In FIG. 2. the details of the electrolytic cell 12 utilized during testing procedures is there shown. A cylindrical glass or nylon non-conductive housing 14, open at each end, includes a moveable non-conductive end member 46 and 48 at each end thereof. These end members 46 and 48 are sealed within the housing 14 by O-rings 62 and 64. The relative spacing between these end members 46 and 48 is controlled by the movement of end plates 50 and 52 thereagainst.

Also shown in FIG. 2 is an in-line heater 21 disposed between the filter 22 and the cell 12. This heater 21 is provided to heat the electrolyte liquid 59 as it flows through the system 10 and the cell 12. Note importantly that the heater 21 may be positioned anywhere in the dosed system electrolyte flow path as the heating applied is of a steady state nature rather than only a preheating condition of the electrolyte, although positioning of the heater 21 is preferred to be adjacent the inlet 54 of the cell 12 for better liquid electrolyte temperature control. The heating of the electrolyte external to the cell 12 is one means for triggering and enhancing the catalytic reaction within the cell 12 to produce a positive temperature differential (ΔT) of the electrolyte as it flows through the cell 12. Another means preferred for triggering this heat production reaction between the electrolyte 59 and a bed 35 of conductive particles 36 within the cell 12 is by the application of sufficient electric d.c. current across electrodes 15 and 16 as described herebelow.

Each of the end members 46 and 48 includes an inlet stopper 54 and an outlet stopper 56, respectively. Each of these stoppers 54 and 56 define an inlet and an outlet passage. respectively into and out of the interior volume, respectively, of the electrolytic cell 12. These end members 46 and 48 also include a fluid chamber 58 and 60, respectively within which are mounted electrodes 15 and 16, respectively, which extend from these chambers 58 and 60 to the exterior of the electrolytic cell 12 for interconnection to a constant current-type d.c. power supply (not shown) having its negative and positive terminals connected as shown. Also positioned within the chambers 58 and 60 are thermocouples 70 and 72 for monitoring the electrolyte temperature at these points of inlet and outlet of the electrolytic cell 12. However, in the experiments reported herebelow, the inlet temperature of the liquid electrolyte was measured just outside of the cell 12 immediately upstream of stopper 54 to more accurately resect true temperature differential (ΔT) of the liquid electrolyte 59 while passing through the cell 12.

Thus, all exposed surfaces to the liquid media are nonmetallic except for the conductive beads and the conductive grid.

A plurality of separate, packed conductive beads or particles 36 are positioned to define a bead bed 35 within housing 14 immediately adjacent and against a conductive foraminous or porous grid 38 formed of platinum and positioned transversely across the housing 14 as shown. These conductive beads 36 are described in detail herebelow.

Still referring to FIG. 2. a non-conducive foraminous or porous nylon mesh 40 is positioned against the other end of these conductive particles 36 so as to retain them in the position shown. Adjacent the opposite surface of this nonconductive mesh 40 is a plurality of non-conductive spherical beads, or more generally particles, 42 formed of crosslinked polystyrene and having a nominal diameter of about 3.0

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mm. Against the other surface of this layer of nonconductive beads 42 is a conductive foraminous or porous grid 44 formed of platinum and positioned transversely across the housing 14 as shown.

Should the system 10 boil off or otherwise inadvertently lose all liquid electrolyte within the cell 12, a means of preventing system damage is preferred which replaces the non-conductive beads 42 with non-metallic spherical cation ion exchange polymer conductive beads preferably made of cross-linked styrene divinyl benzene having fully presulfonated surfaces which have been ion exchanged with a lithium salt. This preferred non-metallic conductive microbead structure will thus form a "salt bridge" between the anode 44 and the conductive particles 36, the non-conductive mesh 40 having apertures sufficiently large to permit contact between the conductive particles 36 and the conductive non-metallic microbeads. The mesh size of mesh 40 is in the range of 200-500 micrometers. This preferred embodiment thus prevents melting of the sulfonated nonconductive beads 42 while reducing cell resistance during high loading and normal operation.

The end of the electrode 15 is in electrical contact at 66 with conductive grid 38. while electrode 16 is in electrical contact at 68 with conductive grid 44 as shown. By this arrangement, when there is no electrolyte within the electrolytic cell 12, no current will flow between the electrodes 15 and 16.

ELECTROLYTE

When the electrolytic cell 12 is filled with a liquid electrolyte 59, electric current will flow between the electrodes 15 and 16. The preferred formulation for this electrolyte 59 is generally that of a conductive salt in solution with water. The preferred embodiment of water is that of either light water ($H_2{}^1O$) or heavy water and, preferably deuterium ($H_2{}^2O$). The purity of all of the electrolyte components is of utmost importance. The water ($H_2{}^1O$) and the deuterium ($H_2{}^2O$) must have a minimum resistance of one megohm with a turbidity of less than 0.2 N.T.U. This turbidity is controlled by ultra membrane filtration. The preferred salt solution is lithium sulfate (Li_2SO_4) in a 1-molar mixture with water and is of chemically pure quality. In general, although a lithium sulfate is preferred. other conductive salts chosen from the group containing boron, aluminum, gallium, and thallium, as well as lithium, may be utilized. The preferred pH or acidity of the electrolyte is 9.0.

CONDUCTIVE PARTICLES OR BEADS

Preparation of Non-Conductive Cores

Spherical polymer beads were prepared which would contain a poragen of a low molecular weight polystyrene (45,000 mw). The ratios of divinylbenzene (DVB) to polystyrene was 60/40. The sample of resin was sulfonated to undergo a weight analysis.

A mixture of DVB (95 g.) containing 80.4% active ingredient with no inhibitor and 5.0 g polystyrene (45,000 mw) was stirred until all was dissolved. To this mixture was added 1.2 g benzoyl peroxide (1.25%) and stirred until all dissolved. This mixture was charged to the 2-liter reaction kettle equipped with a stirrer, reflux condenser, and thermometer which contained 10.0 g Marsparse (1.0%), 10.0 g acacia (1.0%) and 1000 ml. deionized (D.I.) water. The mixture was stirred until the organic components were dispersed as fine droplets. The mixture was heated to 86° C. for 4 hours. This process is known as suspension polymerization. The polymer beads were filtered and washed with D.I. water. The beads were air dried overnight. The weight was 93.4 g.

Forty (40)g of the neutral resin were added to 300 ml (99%) sulfuric acid with stirring. The mixture was heated to 100° C. for 2 hours. The mixture was cooled to about 20° C. and slowly added to a large quantity of water. The beads were filtered and washed with D.I. water to neutral. The beads were air dried to a final weight of 39.6 g. The beads were tan in color and large craters could be observed on the surface of the beads.

A summary of the above preparation results of these non-conductive cores is shown in Table I herebelow.

TABLE I

SAMPLE	DVB (g)	PS (g)	PS (MW)	NEUTRAL Resin (g)	AFTER Me_2Cl_2 (g)	A. AFTER SONICATE (g)	NEUTRAL RESIN (g)	B. SULFONATED RESIN (g)
JAP-2	95	5	45,000	46.7	48.1	44.2	40.0	39.6

Preparation of Conductive Beads

A sample of the above prepared non-metallic cores were screened using a #16 screen (Tyler 14 mesh, 1.18 mm openings) to +#16. ten (10) cc of each mesh size were mixed with a mixture of 30 ml D.I. H_2O and the following Uranium and Thorium salts:

Uranium nitrate $UO_2(NO_3)_2$ 1.9×10^{-3} **moles**

Thorium nitrate $Th(NO_2)_4$ 0.9×10^{-3} **moles**

Each sample was heated in an infrared oven to 180° C. or to dryness. The beads were then mixed while still hot and placed in a 20 ml. ceramic crucible. The loaded crucible was then fired over a period of 2 hours to a temperature of 500°C., the decomposition temperature of $Th(NO_2)_4 > ThO_2$. At this point. the $UO_2(NO_3)_2$ had also decomposed to UO_4 (yellow)>UO_2 (dark green), both of which were insoluble in water.

TEST FOR RADIOACTIVITY

Two (2.0) cm^3 of the dry, activated conductive beads were placed into a standard prepared well of a radiation counter. SE International Monitor #4 standardized with Cesium 137. The monitor window was also machined to fit the curvature of the 1.9 cm diameter nylon cell housing 14 so that relatively accurate monitoring of the bead bed 35 in the cell 12 could be obtained during cell operation.

In the standard well, 2 cc of beads produced a radioactivity count of 3000 counts per minute (cpm). After packing in the cell 12, the housing 14 being nylon, the radioactivity count was 300 cpm. When the liquid electrolyte 59 (0.5 m Li_2SO_4) was passed onto the cell 12, bead radioactivity dropped to 150 cpm.

CELL RESISTANCE

In preparing the electrolytic cells for testing, the cell resistance utilizing a Whetstone Bridge or ohm meter was utilized prior to the introduction of the electrolyte into the electrolytic cell. This cell resistance, when dry, should be infinitely high. Otherwise, a short between the anode screen and the cathode beads exists and the unit would have to be repacked. When testing with electrolyte present at 0.02 amps, the resistance should be in the range of 100 to 200 ohms per sq. cm of cross section area as measured transverse to the direction of current flow.

RELATIVE SURFACE AREAS

The range in diameters of the conductive particles as above described is relatively broad, limited primarily by the ability to plate the cores and the economic factors involved therein. As a guideline however., it has been determined that there exists a preferred range in the ratio between the total surface area of all of the conductive particles collectively within the electrolytic cell and the inner surface area of the

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non-conductive housing which surrounds the bed of conductive particles.

A minimum preferred ratio of the total bead surface area to the inner housing surface area is in the range of 5 to 1 (5:1). However, an ideal area ratio is 10 to 1 (10:1) and is typically utilized in the experiments reported herebelow. This ratio is thus affected primarily by the size of the conductive particles. the smaller the diameter, the higher the ratio becomes.

EXPERIMENTAL RESULTS

The testing procedures incorporated two stages. The first stage may be viewed as a loading stage during which a relatively low level current (approx. 0.05 amps) is introduced across the conductive members, that current facilitated by the presence of the electrolyte 59 as previously described.

LOADING

During the initial loading, electrolysis of the aqueous media within the liquid electrolyte occurs so that the hydrogen active surface of the conductive particles fully absorbs and combines with hydrogen. i.e. becomes "loaded". This loading takes about two hours under a current flow through the cell of about 0.05 amps per two (2) cm^3 of particle volume. As the particles load with hydrogen, the resistance of the cell will be seen to increase. The cell's resistance measured at constant temperature should be seen to raise about 10%. It is recommended that the loading should proceed at least until the resistance is no longer increasing. As loading proceeds further, a decrease in resistance will appear.

TEST RUN

After hydrogen and/or hydrogen isotope, loading of the hydrogen active material of the conductive beads, the current level between conductive members is then incrementally increased, during which time the electrolyte temperature differential is monitored. The temperature of the electrolyte 59 circulating through the electrolytic cell 12 and system 10 was fully monitored, along with temperature differential between thermocouples 70 and 72 and flow rate of the liquid electrolyte 59. Preferably, and more accurately, in lieu of placing the thermocouple 70 as shown in FIG. 2, the electrolyte inlet temperature was monitored immediately upstream of stopper 54 to more accurately reflect temperature differential (ΔT).

In general, all tabular results herebelow represent data taken on a steady state basis, input and output temperatures of the liquid electrolyte 59 being taken upstream of stopper 54 and at 72. respectively, voltage (v) and current flow (a) across the electrolytic cell 12 measured between terminals or conductors 15 and 16. The flow rate of the liquid electrolyte 59 (ml/min) and calculated wattage input and wattage output and percent yield are also shown. Wattage input to the cell 12 is calculated as the product of voltage (v) X amps (a), while wattage output is calculated based upon a formula for converting calorific heat to power and watts according to a formula

Watts Out = Flow Rate (liters per minute)xΔTx70.

RADIOACTIVITY MONITORING

In addition to monitoring the above parameters, radioactivity level in counts per minute (cpm) was also monitored utilizing the above-described modified radi- oactivity sensor fitted around the cell 12. The results of this experiment are summarized in Table II herebelow.

TABLE II

Radio-activity (cpm)	Time	ΔT °C. (To-Tin)	Amps (A)	Volts (V)	Flow Rate (ml/min)	Watts In	Watts Out
150	12:30	−0.2	.00	.00	10	.00	.00
150	12:40	0.9	.02	1.0	10	0.20	0.63
150	12:41	0.9	.03	5.0	10	0.15	0.63
100	1:20	0.9	.07	4.0	10	0.28	0.63
80	1:41	set	.10	8.5–9	10	0.9	—
80	1:50	2.6	.10	7.5	10	0.75	1.82
60	2:20	.0	.10	7.0	10	0.70	0.63
40	5:05	4.4	.14	10.0	10	1.40	3.08
20	9:30	4.5	.12	10.0	10	1.20	3.15

SUMMARY

During steady state operation for a period of approximately 20 hours, the wattage output of the above-described experimental cell 12 within the system 10 produced approximately 2.25 watts of power output in the form of heated electrolyte. Referring to FIG. 1, this heat energy may be utilized by any device or system shown typically at 30 in phantom which is capable of converting heat energy derived from a heated liquid into other forms of energy or use.

After testing, the conductive beads 36 were removed and placed in the standard well of the Turner measuring device and were found to have a radioactivity level of 350 cpm.

Therefore. in addition to the production of excess heat at a rate of 2.25 watts output for a 20-hour period, the radioactivity of the conductive beads dropped from an initial radioactivity count of 3000 cpm to 350 cpm, a loss in radioactivity of approximately 88%.

To insure that the radioactive material had not simply been separated from the conductive beads 36 and redeposited elsewhere in the system 10, a background radioactivity was monitored to be in the range of 2 to 5 cpm. The counter itself was also checked periodically for correct calibration. in addition. the in-line filter 22 showed a radioactivity count after the experiment of background level of between 2 and 5 cpm, the aqueous media or liquid electrolyte 59 also showed an after-test radioactivity count of only 2 to 5 cpm (background level) and all vapor condensed by the gas separator 26 had no trace of any radioactivity whatsoever. The liquid media was then dried and rechecked to insure that no radiation screening had occurred—none had as the radiation count remained at background level (205 cpm). The dried media had a green color. There were no leaks whatsoever of the aqueous media from the system 10 during testing.

EXPERIMENT REPEATED

The above experiment was repeated with the initial radiation count of the conductive beads being approximately 3400 cpm when placed in the standard well of the Turner apparatus. After 24 hours of operation at approximately 0.8 amps, 10 volts and the flow rate of 10 ml per hour, during which time the temperature differential (ΔT) across the electrolytic cell 12 was approximately 3.7° C., the standard well count of the after-run conductive beads was reduced to 500 to 600 cpm, with all other components showing no more than trace or background radiation count levels of approximately 2 to 5 cpm. This repeat test therefore represented a reduction of approximately 84% in radioactivity.

While the instant invention has been shown and described herein in what are conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention, which is therefore not to be limited to the details disclosed herein, but is to be afforded the full scope of the claims so as to embrace any and all equivalent apparatus and articles.

What is claimed is:

1. A system for producing heat and for reducing radioactivity of a radioactive material by electrolysis in a liquid electrolyte comprising:

an electrolytic cell including a non-con ductive housing and an inlet and an outlet;

a plurality of conductive beads each including: a non-conductive core; a

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radioactive metallic actinide combined with and forming a conductive surface over, said nonconductive core;

a first conductive porous grid means in electrical communication with said plu rality of conductive beads;

a second conductive porous grid means electrically spaced from said plurality of conductive beads and which is posi tioned closer to said outlet than said first conductive grid means;

means for pumping said liquid elec- trolyte into said electrolytic cell through said inlet, said electrolyte having a con ductive salt in solution with water, said electrolyte exiting from said electrolytic cell through said outlet;

means for applying an electric current between said first and second conduc- tive grid means.

2. A system as set forth in claim 1, wherein: said conductive surface is taken from the group of metallic actinides consisting of actinium, protactinium, neptunium, plutonium, americium, curium, berkelium. californium, einsteinium, fermium, mendelevium. and lawrencium.

3. A system as set forth in claim 1 wherein: said conductive surface is taken from the actinide series and daughter elements therefrom.

4. A system as set forth in claim 1. wherein: said non-conductive core is sulfonat- ed.

5. An electrolytic cell for producing heat and for reducing radioactivity of a radioactive material by electrolysis in an aqueous media comprising:

a non-conductive housing;

a plurality of conductive beads each including:

a non-conductive core;

a radioactive metallic actinide combined with, and forming a conductive sur face over said nonconductive core;

a first conductive porous grid means in electrical communication with said plu rality of conductive beads;

a second conductive porous grid means electrically spaced from said plurality of conductive beads which is positioned closer to said outlet than said first con ductive grid means.

6. An electrolytic cell as set forth in claim 5. where- in:

said conductive surface is taken from the group of metallic actinides consisting of actinium, protactinium. neptunium. plutonium. americium, curium, berkelium, californium. einsteinium. fermium, mendelevium. and lawrencium.

7. An electrolytic cell as set forth in claim 5, where- in:

said conductive surface is taken from the actinide series and daughter elements thereof

8. An electrolytic cell as set forth in claim 5. where- in:

said non-conductive core is sulfonated.

9. A method of producing heat and reducing radioactivity of a radioactive material by electrolysis in an aqueous media comprising the steps of:

A. providing an electrolytic cell including:

a non-conductive housing and an inlet and an outlet;

a first conductive porous grid posi tioned within said housing adjacent to said inlet;

a second conductive porous grid posi tioned within said housing spaced from said first conductive grid and adjacent to said outlet;

a plurality of conductive beads each including:

a non-conductive core;

a radioactive metallic actinide com- bined with, and forming a conductive surface over said nonconductive core;

B. circulating said aqueous media through said electrolytic cell;

C. passing an electrical current between said first and second grids when said aqueous media is circulating within said electrolytic cell;

D. removing heat from said aqueous media for use external to and separate from said electrolytic cell after said aqueous media exits said electrolytic cell through said outlet;

E. continuing to operate said cell in accordance with steps A, B, C, D until the radioactivity of said radioactive material is reduced.

10. A method as set forth in claim 9, wherein: said aqueous media includes a conductive salt which is lithium sulphate.

11. A system as set forth in claim 9, wherein: said conductive surface is taken from the group of metallic actinides consisting of actinium, protactinium, neptunium, plutonium, americium, curium, berkelium, californium, einsteinium, fermium, mendelevium, and lawrencium.

12. A system for reducing radioactivity of a radioactive material by electrolysis in a liquid electrolyte, comprising:

an electrolytic cell including a non-con ductive housing and an inlet and an outlet;

a plurality of conductive beads each including: a non-conductive core; said radioactive material forming a conduc- tive surface s over said non-conductive core;

first conductive porous grid means in electrical communication with said plu rality of conductive beads;

a second conductive porous grid means electrically spaced from said plurality of conductive beads and which is posi tioned closer to said outlet than said first conductive grid means;

means for pumping said liquid elec- trolyte through said electrolytic cell, said liquid electrolyte including a con ductive salt in solution with water;

means for applying an electric current between said first and second conduc- tive grid means.

13. A system as set forth in claim 12, wherein: said conductive surface includes a metallic actinide taken from the group of metallic actinides consisting of actini- um, protactinium, neptunium, plutoni- um, americium, curium, berkelium, cal- ifornium, einsteinium, fermium, mendelevium, and lawrencium.

14. A system as set forth in claim 12, wherein: said conductive surface includes a metallic actinide taken from the actinide series and daughter elements therefrom.

15. An electrolytic cell for reducing radioactivity of a radioactive material by electrolysis in an aqueous media comprising:

a non-conductive housing;

a plurality of conductive beads each including:

a non-conductive core; a conductive surface formed over said non-conduc- tive core formed of said radioactive material;

a first conductive porous grid means in electrical communication with said plu- rality of conductive beads;

a second conductive porous grid means electrically spaced from said plurality of conductive beads which is positioned closer to said outlet than said first conductive grid means.

16. An electrolytic cell as set forth in claim 15, where- in: said radioactive mate- rial includes a metallic actinide is taken from the group consisting of actinium, protactinium, neptunium, plutonium, americium, curium, berkelium, cali- fornium, einsteinium, fermium, mendelevium, and lawrencium.

17. A method of reducing radioactivity of a radioactive material by electrolysis in an aqueous media comprising the steps of:

A. providing an electrolytic cell including:

a non-conductive housing and an inlet and an outlet;

a first conductive porous grid posi- tioned within said housing adjacent to said inlet;

a second conductive porous grid posi tioned within said housing spaced from said first conductive grid and adjacent to said outlet;

a plurality of conductive beads each including:

a non-conductive core;

a radioactive metallic actinide com- bined with. and forming a conductive surface over said nonconductive core;

B. circulating said aqueous media through said electrolytic cell;

C. passing an electrical current between said first and second grids when said aqueous media is circulating within said electrolytic cell;

D. continuing to operate said cell in accordance with steps A, B, C until the radioactivity of said radioactive material is reduced.

18. A system as set forth in claim 17. wherein: said conductive surface is taken from the group of metallic actinides consisting of actinium, protactinium, neptunium, plutonium, americium, curium, berkelium, californium, einsteinium, fermium, mendelevium, and lawrencium.

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Pre-print from *Journal of New Energy*, Vol. 2, No. 2, 1997, pp.110-118.

OPERATING THE LENT-1 TRANSMUTATION REACTOR: A PRELIMINARY REPORT

By Hal Fox and Shang-Xian Jin

ABSTRACT

The Low-Energy Nuclear Transmutation (LENT-1) reactor can transmute thorium into smaller mass elements. This transmutation process differs markedly from the natural decay of thorium-232 into lead-208. Using a small amount of thorium nitrate dissolved in distilled water as the electrolyte, the LENT-1 reactor will transmute essentially all of the thorium into small mass elements in thirty minutes processing time. Considerable development work is required to understand the role of reactor parameters in producing various transmuted smaller mass elements.

A. INTRODUCTION

Most of the current models of nuclear reactions require that high energy be used to cause nuclear reactions, except for the decay of naturally radioactive substances such as thorium and uranium. Nearly all of the nuclear experimental data has been obtained by experiments based on nuclear reactors or using high energy particle accelerators. The study of nuclear reactions in or on the surface of a metal lattice is relatively new. Two international conferences on Low-Energy Nuclear Reactions have been held and the proceedings published in the *Journal of New Energy* [1,2]. Several important papers have reported on experiments in which low-energy nuclear reactions are observed. This paper reports on the results that have been achieved by various workers using the Low-Energy Nuclear Transmutation (LENT-1) reactor.

The LENT-1 reactor consists of a cylindrical electrode and a disk-shaped electrode positioned on the interior of the cylindrical electrode. See Fig. 1 for an outline drawing of the LENT-1 reactor. Both electrodes are made of a special metal (e.g. zirconium). The reactor includes strong stainless steel end plates and bolts together with Teflon™ seals [Editor's Note: See detailed description in *Infinite Energy*, Vol.3, issue #13/14.]. When properly assembled, the reactor is a pressure vessel capable of processing about 20 to 30 ml of solution. Some of the variable parameters are the following:

Pressure
Temperature
Electric Potential
Electric Current
Input Electrical Power Waveform
(d.c., a.c., pulsing, etc.)
Electrical Parameter Changes
During Processing
Electrolyte Conductivity
Processing Time
Electrode Conditioning

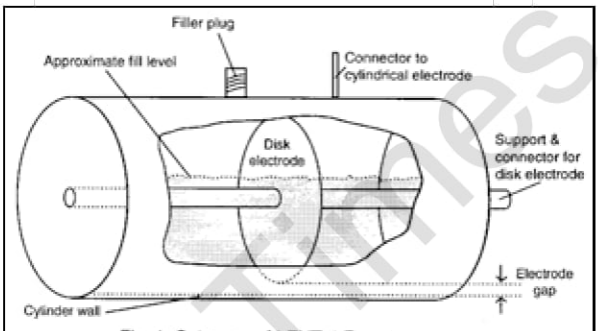

Fig. 1 Cut-away of LENT-1 Reactor

In laboratory experiments over the past three years, the following parameter ranges have been selected or observed: Pressure from 1 to 25 atmospheres; Temperatures from 70°F to 400° F; Electric potential from 25 to 600 volts; Electric current up to 5 amperes; Waveforms normally either a.c. or d.c.; Electrolyte resistance from 2 to 500 ohms; Processing time from 30 minutes to six hours; and a variety of electrode conditioning, usually by anodizing to obtain a high-resistance oxide layer. Experimental results vary widely with changes in parameters. Over three years of experimentation has resulted in useful operating protocols that are highly reproducible in terms of transmuting thorium-232 into lower-mass elements. Elements and amounts of elements produced by transmutation vary significantly from one experiment to another. However, it is expected that exact control of operating parameters will produce essentially the same transmutation results in terms of elements transmuted and amounts of such elements produced.

Low-energy nuclear reactions constitute a new and potentially highly-valuable branch of physics. The theory must follow the experimental results as there are no widely recognized theories that explain all of the experimental observations. This branch of physics is new and will be met with a high degree of skepticism by many physicists. Moderate skepticism is acceptable and expected for all dramatic new discoveries. Excessive skepticism or denial of replicated experimental results by proclaimed authorities must be treated in the same manner as previous declarations against heavier-than-air machines, atomic energy, data processing by machines, and space flight. All of these new discoveries were condemned by self-proclaimed experts.

Replication of experiments with the LENT-1 reactor have been performed by several different groups. Where the protocols are precisely observed, thorium is transmuted into other elements within a thirty-minute processing period. The following is an excellent definition of a scientific fact: "A scientific fact is the close agreement of a series of observations of the same phenomena." With this definition, it can now be stated that low-energy transmutation using the LENT-1 is a scientific fact. However, workers in this new technology will welcome published reports on further replications or for experimental additions to the currently-available experimental data. The purpose of this paper is to provide additional information obtained from a series of recent (September-October 1997) multiple experiments (over a dozen) using the LENT-1 reactor. In addition, this paper provides some important tutorial information.

B. THE USE OF THORIUM NITRATE WITH LENT-1

The element thorium has 26 known isotopes, none of which are stable. However, Thorium-232 is the isotope of thorium that is found in nature. This **almost stable** isotope has a half life (the time it takes for one half of the element to transmute into other elements) of 1.4×10^{10} years or 14,000,000,000 years. Although this thorium isotope is considered to be radioactive, it is only mildly radioactive and can be used in normal laboratories without having to operate under the regulations of the Nuclear Regulatory Agency that are prescribed for handling higher-level radioac-

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tive materials.

Thorium nitrate has the chemical compound symbols of $Th(NO_3)_4 \cdot 4H_2O$. It is labeled by the supplier as Radioactive and Oxidizer. Class 7 (Primary Risk) and Class 5.1 (Secondary Risk). 1 Type A Package x 1.2 X 10^{-5} Curie. Cargo Only Aircraft! This compound is available from Johnson Matthey, Precious Metals Division, 2001 Nolte Drive, West Deptford, NJ 08066. (609)384-7000. Fax (609)384-7282.

Thorium nitrate is readily soluble in water. For careful experiments, only distilled water should be used if you intend to make **before-** and **after-processing** measurements of elements with a parts-per-million accuracy. Water that is not distilled may carry various elements in parts per million quantities that will distract from the accuracy of determining what elements are being produced during transmutation experiments.

Thorium Nitrate, $Th(NO_3)_4 \cdot 4H_2O$, was chosen for testing with the LENT-1 Kit because it is **very soluble** in water. Thorium, in nature, consists of about 100% ${}_{90}Th^{232}$ which is mildly radioactive with a half life of 1.4x 10^{10} years. The entire chain of transmutation events in the natural radioactive decay of thorium is:

$$_{190}Th^{232} \rightarrow {}_{88}Ra^{228} \rightarrow {}_{89}Ac^{228} \rightarrow {}_{90}Th^{228} \rightarrow {}_{88}Ra^{224} \rightarrow {}_{86}Rn^{220} \rightarrow {}_{84}Po^{216} \rightarrow {}_{82}Pb^{212} \rightarrow {}_{83}Bi^{212} \rightarrow {}_{84}Po^{212} \text{ or } {}_{81}Tl^{208} \rightarrow {}_{82}Pb^{208}$$

If the thorium nitrate were absolutely 100% pure and freshly constituted from chemically-pure thorium, one could assume that there would be no decay products. However, the radioactive decay products are continuously produced by the radioactive decay of thorium. The amount of each daughter product in a prepared sample is a function of previous purity of the thorium and the shelf life of the product. The following table provides information on half-lives, decay modes, and energies of emitted particles in the thorium decay series:

RADIOACTIVE DECAY PRODUCTS

When a thorium nucleus decays (transmutes into another element) the general process is for the Thorium-232 to emit an **alpha particle** (essentially an ionized helium-4 nucleus). This alpha particle emission is accompanied by the emission of a **gamma ray**. The gamma ray has a specific energy level of 59 Kev or 59,000 electron volts. A gamma ray is an energetic photon —quantized energetic electro-magnetic radiation. Note that in the above table, seven of the transmutation events emit alpha particles and five emit beta particles (essentially the emission of an energetic electron). Note also that all of the transmutation events in the natural decay of thorium emit gamma rays except for polonium-212.

One can purchase various types of sensors that will measure alpha, beta, and gamma emissions. **It is important to note that naturally radioactive thorium will emit all three: alphas, betas, and gammas.** It is also important to understand that the natural radioactive decay of thorium (and of uranium) is a process that gives off energy carried by the kinetic energy of the daughter elements and by the alpha, beta, and gamma radiation. However, this is not the process that occurs in the artificial transmutation of thorium in the LENT-1 reactor! The nuclear processes in the LENT-1 reactor are **not** an increase in the natural decay rate of thorium. The normal chain of radioactive decay of thorium will continue, of course, in the reactor as the thorium is being processed. This normal radioactive decay will continue with any thorium remaining after the processing by the LENT-1 reactor. If operated by the established protocols, there will be only a very small amount of thorium remaining after the standard thirty minutes of processing time.

The type of nuclear reaction that is believed to take place in the LENT-1 reactor is a process by which one or more protons (ionized hydrogen obtained from the water — H_2O) are injected into the nuclei of the thorium atoms **which have been transported onto or close to the surface of one of the electrodes in the reactor.** Normally these reactions take place on the cathode, however, where a.c. is used it is expected that these reactions take place during the cycle when each electrode is temporarily the cathode. The addition of one or more protons to a thorium nucleus causes the nucleus to become immediately unstable. By fusion of the proton and thorium, protactinium-233 can be produced. Pa-233 decays to U-233 and the U-233 decays by alpha emission to Th-228 which decays by alpha emission to Ra-224 etc. However, it is more likely that the thorium will fission due to the sudden instability by being injected with one or more protons. This disruption of the stability of the thorium nucleus can produce fission of the nucleus into two or more other elements. While the natural decay of thorium ends up as a stable lead isotope (Pb-208, the predominant isotope of lead found in nature), it is expected that the fission of thorium will be into elemental masses that are considerably less massive than lead. As an example, if the thorium were to be injected with 2 protons, the thorium could split into two equal parts, then one would expect to get two nuclei of palladium. More often unequal fission products are expected. Because heavy elements like thorium are **neutron rich** (having a higher ratio of neutrons to protons as compared to the lower mass elements), some unstable isotopes of palladium may be expected (such as Pd-117). These isotopes generally have short half lives and decay into other elements such as silver, cadmium, indium, or tin by beta emission. The beta emission process occurs as a neutron in the nucleus emits an electron and becomes a proton. This is one way that the excess neutrons are consumed. An alternative would be the release of neutrons. Fortunately, the nuclear reactions that are observed are beta emissions rather than the emission of neutrons.

Nuclear reactions are complex but not complicated. A study of a chart of the nuclides will show that unstable elements below the mass of lead will normally decay (transmute) into other elements by beta decay. Therefore, the newly-produced element has one less neutron and one more proton. The study of nuclear radiation (often resulting from studies of the results of nuclear reactions in the fuel pellets in a nuclear power plant) has produced a great deal of information as to what elements are produced from the fissioning of uranium. In general, nearly all of the elements produced by the fissioning of heavy elements (such as U-235) are either stable or are radioactive and exhibit further transmutation by **beta decay!** However, the natural radioactive decay events often pro-

TABLE I. THORIUM DECAY DAUGHTER PRODUCTS

Element	Half-Life	α (MeV)	β (MeV)	γ (KeV)
Thorium-232	1.4 x 10^{10}y	4.01, 3.95	--	59(w)
Radium-228	5.76 y	--	.039, .015	14(w)
Actinium-228	6.15 h	--	1.2, 2.1	911, 969, 338
Thorium-228	1.91 y	5.42, 5.34	--	84, 216, 132, 166
Radium-224	3.66 d	5.69, 5.45	--	240
Radon-220	55.6 s	6.29	--	550
Polonium-216	0.145 s	6.78	--	805(w)
Lead-212	10.6 h	--	.331, .569	239, 300
Bismuth-212	60.6 m	6.05	2.25	40, 727
Polonium-212	298 ns	8.78	--	--
Thallium-208	3.05 m	--	1.8, 1.28, & 1.52	2615, 583, 511
Lead-208	stable			

SOURCES: Lapp et al., [3], Hunt [4].

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duce alpha particles. Those who proclaim that the LENT-1 reactor must produce neutrons need to be aware of the extensive experimental evidence, especially with reactors of the class of the LENT-1.

It is true that heavy elements are **neutron rich**, that is, these heavy elements have a higher ratio of neutrons to protons as compared with lower-mass elements. **However, these neutrons do not have to be emitted under nuclear fission processes.** Nature has decreed that these excess neutrons can be transmuted into protons in the nucleus by the emission of electrons. The end result is important in the determination of the transmutation results in the LENT-1 reactor. Please note that the elements produced by transmutation in the LENT-1 reactor are not always expected to be stable elements. The experimental evidence is that immediately after the processing of thorium in the LENT-1 reactor, one or both of the reactor electrodes are radioactive (meaning that the electrodes emit some combination of alpha, beta, and gamma emissions).

In the processing of the thorium-laden electrolyte, the measurements of emission made using a Geiger counter are as shown in the following table:

TABLE II. Before & After Geiger Counter Readings from Electrolyte
Table Data in Counter per Minute

	Sample B	Sample C	Sample D	Sample E
Before Processing*	39 ± 17	43 ± 17	41 ± 17	41 ± 17
After Processing	Background	Background	Background	Background

* Counts after subtracting background.

Those who are somewhat knowledgeable in electrochemistry would immediately declare that the thorium has been removed from solution and plated out of solution onto the electrodes. This concept is not unreasonable. However, alternating current, as used with the specific protocols for the operation of the LENT-1 reactor is not expected to be effective in plating thorium onto the reactor electrodes. **Here is how to measure whether the thorium has plated onto the electrodes:**

TEST 1. The naturally radioactive thorium emits alpha and gamma particles. The daughter products emit alpha, beta, and gamma radiation. The lower-mass fission products from thorium produced in the LENT-1 reactor are expected to be stable or only emit beta active isotopes, if the thorium is totally transmuted to the low-mass isotopes. Because of the large size of the alpha particles (a helium-4 nucleus consisting of two neutrons and two protons) any emitted alpha particles can be stopped by one to a few sheets of paper. The smaller beta particles (essentially energetic electrons) can penetrate the barrier of a few sheets of paper. Using an alpha sensor (detector) and a beta sensor (detector) the thorium emissions will have both alpha and beta emissions. The expected nuclear fission products that cause the electrodes to become radioactive are expected to produce mainly beta emissions. (However, if the thorium and the daughters are not totally transmuted to low-mass isotopes, or the thorium and a proton fuse into protactinium (Pa^{233}) and which decays into lower mass isotopes, then there can be emissions of α,β, and γ.)

TEST 2. The naturally radioactive thorium has a very long half life of about 14 billion years. If the radioactive emissions from the electrode are due solely to thorium being plated onto the electrode, the degree of radioactivity from the electrode will not change with time over a few days or even a few years. **If the radioactive emissions from the electrode are due to beta decay, then it is expected that these emissions will decrease with time of a few hours to a few days.** Depending on the elements being produced by transmutation in the LENT-1 reactor, the half-life of these elements (beta emitters) will be a combination of the various elements produced. In some of the experiments that have been done, the average time for the reduction of the beta emission from the electrode **after processing** ranges from an estimated 25 hours to 100 hours. This rapid decrease in radioactivity cannot be due to the plating of thorium onto the electrodes. See Fig. 4.

Because of the large number of parameters that can have different values, there may be cases where thorium is plated onto the electrodes. There may be cases where there is a combination of plating and nuclear reduction of thorium. And there may be cases where protactinium is produced with its resultant alpha particle emission. The above tests will help to determine to what extent the thorium is present on the electrodes. However, to determine just what elements are on the electrode(s) gamma-ray spectroscopy can be used.

C. GAMMA-RAY SPECTROSCOPY

The use of gamma-ray spectroscopy is an appropriate choice of instrumentation to use with these experiments because all of the daughter products of thorium emit gamma rays except for polonium-212 which has a half life of 298 nanoseconds. **The assumption is made that the total emission of gamma rays is an acceptable measure of the amount of radiation in a sample prior to processing. It is further assumed that the same gamma-ray total emissions after processing is an acceptable measure of radioactivity.** If we observe an experimental procedure in which the radiation of container, electrodes, and gaseous effluent (if any) are the same before and after processing, then we assume that the changes in radioactivity of the electrolyte is an appropriate measure of the before and after amount of radioactivity. (Often, the short-term radioactivity of the electrodes has decreased to near background by the time that samples are processed by local chemical laboratories.) You may want to submit samples of **before-processing** and **after-processing** to laboratories with suitable gamma-ray spectroscopes. Each element emits gamma rays having different energy levels. By using instrumentation that can measure the various energy levels one can determine what elements are present. Such equipment, if properly calibrated and operated, can be used to determine which elements are present in the **before-** and **after-processing** samples.

The gamma-ray spectroscope can be used immediately after processing to observe the emissions from the electrodes. If the spectroscope is sufficiently sensitive it will be possible to determine exactly which isotopes are decaying by beta decay. A complete low-cost spectroscope can consist of a sodium iodide detector, a power supply, a multi-channel analyzer (mounted on printed-circuit boards that go into a personal computer) and the proper computer software. Such equipment can be obtained for about $5,000. This type of equipment will be very helpful for the LENT-1 experimenter. For better spectroscopes, cryogenic cooling and vacuum systems are required. These features add an estimated $15,000 to the spectroscope.

If the LENT-1 reactor is properly used, the entire thirty-minute process is operated within a sealed reactor so that no gaseous effluent is released during processing. However, there may be some gaseous elements such as helium, argon, chlorine, etc. that may be a by-product of some nuclear transmutations. Such gases may be released when removing the filler plug from the reactor. There is no expectation that any thorium would be lost with the release of such a gaseous effluent. Using suitable professional laboratory equipment (such as a gamma-ray spectroscope), the electrodes can be examined to determine what elements are present on the electrode itself. Only a small amount of thorium has been determined to be a part of the

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eroded electrode that is the result of running a thirty-minute experiment.

In LENT investigation the most important measurement may be EDX (Energy Dispersive X-ray Spectroscopy) or ICP/MS (Inductively Coupled Plasma/Mass Spectrometry) analysis combined with SIMS (Secondary Ion Mass Spectrometry), and with AES (Auger Electron Spectroscopy) for determination of elements and their isotopes.

D. PRELIMINARY DATA FROM EXPERIMENTS

The LENT-1 reactor was used with a variable power supply in efforts to replicate the experimental results of the transmutation of thorium. The basic experimental equipment used was a power supply which allows for the selection of either a.c. or d.c. power from ten to five hundred volts. These particular experiments used the LENT-1 reactor obtained from the Cincinnati Group; the power supply; and a computer-acquisition system for counting and storing data from a Geiger Counter. The entire equipment used for these experiments cost less than $5,000 including $3,000 attributed to the cost of the LENT-1 Kit. Therefore, even small companies can participate in the development of this new technology.

The LENT-1 reactor consists of a cylindrical electrode with a disk-shaped inner electrode so that the electrical current flows from the disk to the inside of the cylindrical electrode. The plane of the circular-disk electrode is perpendicular to the axis of the cylindrical electrode. The reactor is operated with the axis of the cylindrical electrode parallel to the laboratory bench top. The reactor is filled about half full of a mixture of thorium nitrate and distilled water. See Fig. 1 for an outline drawing of the reactor.

The resistance of this special electrolytic cell is a function of the amount of thorium nitrate, the spacing between the disk electrode and the cylindrical electrode, the temperature of the electrolyte, and the chemical changes that are caused in the electrolyte during processing. The resistance of the cell changes dramatically, as computed by the voltage divided by the current, during the processing time. Fig. 2 shows a plot of the cell resistance (and cell temperature) with processing time.

At the initiation of the processing of the thorium solution, about 100 watts of power is introduced into the reactor. This power input causes a gradual rise in temperature of the reactor as measured by a digital thermometer with a surface sensor affixed to the outside of the cylindrical electrode of the reactor. Following the prescribed protocols provided with the LENT-1 Kit, the voltage is increased by ten-volt steps as the current decreases (the internal resistance of the electrolyte increases). Therefore, the experiments are operated using an approximately constant power input. After about fifteen minutes of operation the temperature of the electrolyte stabilizes at about 375°F ± 50° F. One may expect that the nuclear reactions would cause an extreme amount of heat to be produced. However, the complexity of nuclear reactions that appear to be present can be a combination of exothermic (heat producing) and endothermic (heat using) reactions.

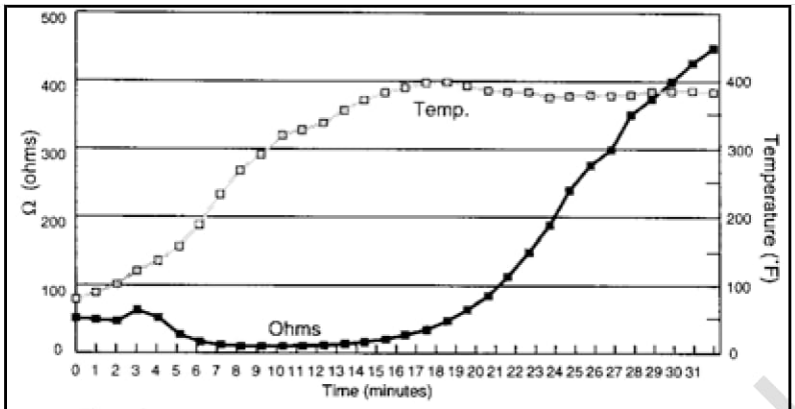

Fig. 2 The Variation of the Resistance & Temperature of the LENT-1 cell with processing time.

From about fifteen to thirty minutes of the processing time, the resistance of the electrolytic cell strongly increases. This experimental measurement suggests that the thorium ions are being removed from solution faster than other chemical ions are added to the solution. The data from the same experiment as shown in Fig. 2 has been plotted against the input energy to the reactor. See Fig. 3. There is a noticeable difference between the curves in the two figures 2 and 3. Both the temperature rise curve and the rise in the cell resistance, when plotted against total energy input, have portions that are relatively linear. This observation suggests teat, as expected, the temperature of the cell is roughly a linear function of the input energy for the first ten minutes of operation. Also, the rapid increase in cell resistance is quite linear after about 20 minutes of operation. In one experiment, the cell was operated for an additional thirty minutes. The voltage was controlled to keep the temperature of the reactor about constant (as a safety precaution). The result was that a continuous 80 watts of electrical power was fed into the cell. Both temperature and cell resistance remained essentially constant. The explanation is that the cell, at temperatures near 400° F, is radiating all of the 80 watts of input power. This measurement is important for our evaluation of where the input energy is being used and as a basis for a later determination of the amount of energy it takes to drive the desired nuclear reactions.

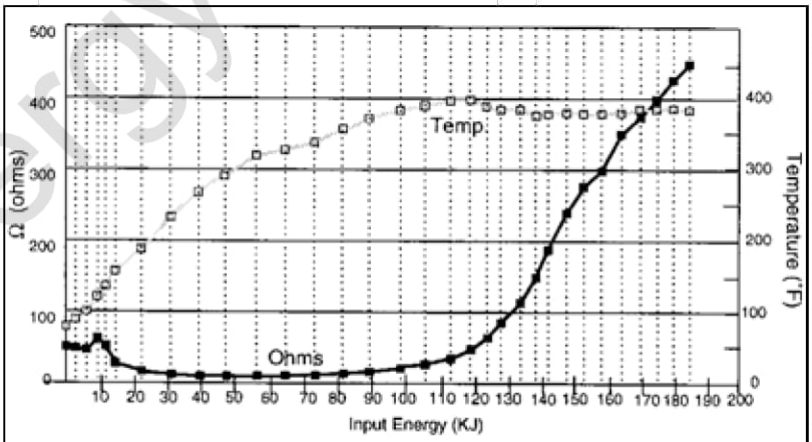

Fig. 3 The Variation of the Resistance & Temperature of the LENT-1 cell with Input Energy (measured each minute)

As inferred by the temperature of the reactor, the internal pressure of the cell ranges from atmospheric pressure at the start to as high as more than twenty atmospheres (about 0 to 400 psig). If proper assembly and operation of the cell has taken place, the steam produced from the heating of the electrolyte is contained within the cell. Note: due to the possibility of the generation of very high pressures, this experimental apparatus should be placed behind a barrier in the case of any fracture of the reactor! **THIS IS NOT A TOY AND SHOULD BE USED ONLY BY SAFETY - AWARE TRAINED EXPERIMENTERS.**

BEFORE & AFTER RESULTS

The electrolyte, the disk electrode, and the inner surface of the cylindrical electrode were measured for radioactive emanations by using a Geiger counter. The before-processing measurements of the electrodes were essentially at background.

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The initial thorium solution showed counts considerably above background. The **after-processing** measurements showed dramatic reduction of radioactivity of the electrolyte **and dramatic increase of the radioactivity on the surface of the electrodes.**

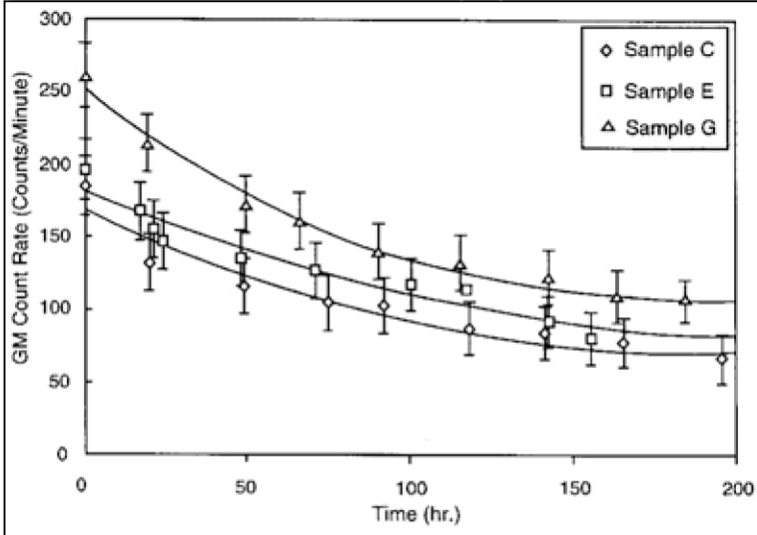

Fig. 4 The Radioactive Decay of the Disk Electrode of LENT-1 After the Processing 9/30/97

However, measurements made by placing the disk electrode near the sensor of the Geiger counter showed that the radioactivity of the electrodes is dramatically reduced, apparently on an exponential basis, from about three times background to about one-third above background, over a period of less than 100 hours. See Fig. 4 for typical radiation measurements over a 200-hour period. Note that the combined half-life of the elements that are producing the radioactive emanations ranges from about 50 to 100 hours in different experiments. Some of the disk electrodes were measured using a borrowed alpha detector. A low level of alpha particle emission was noted. The alpha emissions are believed to be a combination of some small amount of thorium and some small amounts of protactinium and its daughter products.

A careful inspection of a Chart of Nuclides will show that any reasonably expected fissioning of a heavy element will result in smaller elements. However, the elements produced can be expected to be among those hundreds of short-lived elements that are "radioactive," usually with short-half lives where the element is transformed into another element by beta-emission.

The **before-processing** and **after-processing** samples of the electrolyte were submitted for ICP [inductively coupled plasma] mass spec analysis. The most notable change in the 12 elements selected for analysis was the dramatic decrease (by over 95%) in the amount of thorium in the electrolyte. Due to the relative high costs of analytical services, a complete elemental analysis has not as yet been accomplished. A commensurate number of newly-produced elements has not, as yet, been determined. Copper and silicon were noticeably increased in the solution. It must be recognized that many of the elements that could have been produced could combine with electrolysis by-products, notably H and O ions, to produce compounds that are not soluble in the aqueous electrolyte. Of course, the change in ion content of the electrolyte is evident by the dramatic increase in the resistance of the electrolyte (Fig. 2 and Fig. 3).

E. SUMMARY

The LENT-1 is one of an increasing number of devices that exhibit transmutation of elements. These nuclear reactions have been replicated by a few investigators, however, more independent replications and more extensive post-processing analysis will be required to convince skeptics of the reality of this new technology. Working with thorium is an advantage because thorium does not require a "hot lab" environment. Sufficient short-term radioactivity of transmuted products is produced in the LENT-1 which is an advantage to track the nuclear reactions that modify neutrons into protons by beta emission. Typical data indicates that the bulk of the nuclear reactions occur within about a fifteen minute time period of the thirty-minute typical period that transmutes most of the thorium from the electrolyte. Due to the nature of the nuclear reactions, considerable chemical and isotopic analysis will be required by serious experimenters.

ACKNOWLEDGEMENTS

Data for this preliminary report has been provided by permission of Trenergy, Inc., the Utah corporation that funded the experimental investigation. Mr. Stan Gleeson of "the Cincinnati Group" has furnished the LENT-1 reactor. Dr. S-X. Jin has been responsible for obtaining this basic (and preliminary) data.

REFERENCES

1. Hal Fox, editor, *Proceedings of the First Conference of Low-Energy Nuclear Reactions*, (Texas A&M, June 19, 1995) published in *Journal of New Energy*, vol 1, no 1, Jan 1996.

2. Hal Fox, editor, *Proceedings of the Second Conference of Low-Energy Nuclear Reactions*, (College Station, Texas, Sept 13-14,1996) published in *Journal of New Energy*, vol 1, no 3, Fall 1996

3. R.E. Lapp, H.L. Andrews, *Nuclear Radiation Physics* (1992), Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

4. S.E. Hunt, *Nuclear Physics for Engineering and Scientists* (1987), Ellis Harwood, Ltd., Market Cross House, Cooper Street, Chichester, West Sussex, P019 1 EB, England.

Important references for further information: **The papers marked with (*) are especially pertinent.**

* Robert Bass, Rod Neal, Stan Gleeson, Hal Fox, "Electro-Nuclear Transmutation: Low-Energy Nuclear Reactions in an Electrolytic Cell," *Journal of New Energy*, vol 1, no 3, Fall 1996.

* Ken Shoulders, Steve Shoulders, "Observation on the Role of Charge Clusters in Nuclear Cluster Reactions," *Journal of New Energy*, vol 1, no 3, Fall 1996.

Yeong E. Kim, Alexander L. Zubarev, "Gamow Factor Cancellation and Nuclear Physics Mechanisms for Anomalous Low-Energy Nuclear Reactions," *Journal of New Energy*, vol 1, no 3, Fall 1996.

* Hal Fox, Robert W. Bass, Shang-Xian Jin, "Plasma-injected Transmutation," *Journal of New Energy*, vol 1, no 3, Fall 1996.

* Shang-Xian Jin, Hal Fox, "Characteristics of High-Density Charge Clusters: A Theoretical Model," *J. of New Energy*, vol 1, no 4, p 595, Winter 1996, 16 refs, 2 figs.

Bockris and Minevski, "Two Zones of Impurities Observed After Prolonged Electrolysis of Deuterium on Palladium," *Infinite Energy*, vol 1, no 5&6, 1996, pp 67-69.

Mizuno, Ohmori, Enyo, "Isotopic Changes of the Reaction Products Induced by Cathodic Electrolysis in Pd," *Journal of New Energy*, vol 1, no 3, Fall 1996.

Nuclear Wastes: Technologies for Separations and Transmutation, Committee on Separations Technology and Transmutation Systems, Board on Radioactive Waste Management, Commission on Geosciences, Environment, and Resources, National Research Council, published by National Academy Press, Washington, D.C. @1996 by the National Academy of Sciences. [The essence of this large report is that there was no process known to the committee members that would be more economical than geologic storage of radioactive wastes. **Now there is.**]

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Speculations on the Mechanisms of Thorium Transmutation by the Cincinnati Group

by David Moon, 8 September 1997

The recent detailed disclosure [1] of the profound discovery by The Cincinnati Group (CG) of the transmutation of large quantities of radioactive thorium (as aqueous thorium nitrate) into lower-Z elements (mostly copper, titanium, and iron) in a special electrolysis apparatus has caused probably more than one cold fusion theorist to "hypermentalate." How do you explain the fission of Th-232 into Cu-65, etc., and keep the reactions ANEUTRONIC and ATHERMAL, as reported?

We may start with the fission reaction, as does Hal Fox in *New Energy News* [2], of ${}_{90}Th^{232} + {}_{1}H^{1} = {}_{29}Cu^{65} + {}_{22}Ti^{50} + {}_{40}Zr^{96}$ + 22 neutrons. Thus, we are presented with the situation of picking up 22 neutrons in this sample reaction. Most theorists, such as Dr. Robert W. Bass [3] and Dr. Robert D. Eagleton [4] to name only two, have assumed, as does this author, that scores of protons must almost simultaneously impinge upon the thorium nucleus, each scavenging a neutron to become a deuteron (in this example, 22 deuterons form). In addition, one or two (or more) of the invading protons end up disrupting the Th-232 nucleus to stimulate fission:

(a)

$$\mathbf{{}_{90}Th^{232} + 23({}_{1}H^{1}) = {}_{29}Cu^{65} + {}_{22}Ti^{50} + {}_{40}Zr^{96} + 22({}_{1}H^{2})}$$

There are at least two theories proposed to accomplish the large flux of invading protons seemingly needed in this type of thorium fission. One is the Plasma-Injected Transmutation (PIT) concept of H. Fox, S. X. Jin and R. W. Bass [5] and the related Charge Cluster (EV) Model of K. Shoulders [6]. These theories have been well explained and established and cannot be added to in this article.

Another mechanism sometimes might be at work to bring in the flux of protons around a thorium atom to initiate its low-energy fission. In this model, strings or chains of protons swirl inside an energetic plasma vortex[7]. It is speculated here that, in the CG's thorium transmutations, spiraling proton plasmas may actually envelop single (or at most a few) thorium atoms. A shrinking, focused vortex of protons perhaps could squeeze very close to the electron cloud of a thorium atom, eventually entering it.

Considering again reaction (a) above, it is noted that the Q-value equals 118 MeV —far from ATHERMAL. The energy cannot be distributed mostly to the 22 deuterons that form. This excess heat dilemma in the CG experiments may have a couple of solutions.

First, it is postulated in reaction (a) that most or all of the 23 reacting protons— swirling within the proton plasma around the thorium atom—eventually enter the atom's electron cloud to weakly capture an orbital electron, becoming an "unstable mononeutron" (UMN, denoted n*), which is henceforth termed a "hydron" at the suggestion of Dr. Millennium Twain [8].

The hydrons then find their way into the outermost nucleon shells of the thorium nucleus (and daughter nuclei during the series of fission steps) to disrupt it. Fission begins as the proton contained within the hydron gets absorbed by the thorium nucleus while an electron-antineutrino pair is ejected from this hydron. It has been theorized that the antineutrino must carry most of the nuclear energy released [9], and the fission fragments such as Cu-65, H-2 and He-4 take up minimal energy. Reaction (a) now is written:

(a-2)

$$\mathbf{{}_{90}Th^{232} + 23({}_{1}n^{*}) = {}_{29}Cu^{65} + {}_{22}Ti^{50} + {}_{40}Zr^{96} + 22({}_{1}H^{2})^{*note} + 23({}_{-1}e + \nu)}$$

***note Some deuteron pairs likely form He-4 nuclei in these types of reactions.**

Besides neutrino loss, there is another way to explain the apparent lack of excess heat production in thorium remediation by the CG inventors. It is offered by Prof. Robert Eagleton of Cal Poly at Pomona, California [4].

In his theory, Dr. Eagleton suggests that the thorium fission is multi-modal, yielding many gaseous fission fragments while at the same time following reaction paths of least Q release—a kind of Principle of Least Action.

For example, reaction (b) below—which is reaction (1) in reference [4] —is adapted to the model here (where protons react as hydrons):

(b)

$$\mathbf{{}_{90}Th^{232} + 38(n^{*}) = 6({}_{2}He^{4}) + 2({}_{29}Cu^{65}) + 3({}_{8}O^{16}) + 34({}_{1}H^{2}) + 38({}_{-1}e + \bar{\nu})}$$

In reaction (b), Q equals only about 9,000 eV, thus predicting an essentially ATHERMAL fission even without the energy escape via neutrinos.

Prof. Eagleton's theory to explain the CG thorium data evokes a highly speculative, nonetheless tempting hypothesis concerning the general structure of nuclei of the very heavy elements. Examining the proposed daughter nuclei in reaction (b), it is observed that only copper is the solid product. The other products are gasses.

Is it reasonable to state that the Th-232 nucleus is made up of an inner core of metal nuclei (Fe and near Fe), a middle layer of heavy gasses and an outer region of light gasses? The fission mode, of course, depends on many factors [10]. But the preponderance of near-iron nuclides formed during fission of thorium-232 by the CG personnel is indeed curious.

From A Bag Of Groceries.....
.....To A Bag Of Gold

Jed Rothwell, citing the many highlights from Prof. George H. Miley's detailed transmutation analyses of Patterson-type nickel-coated beads (in 1996), wrote [11]: "Miley has succeeded too well in finding transmutations. He has found that Pd, Ni, Ti and Au all react to some extent. It is becoming a little difficult to select material suitable for electrolysis in a blank cell that does not transmute!"

It is a veritable fact that cold fusion researchers routinely find "grocery bags full" of new elements in their experiments. One can almost pick and choose a smorgasbord of elements from the Periodic Table.

Then there are the precious metals!

In anticipation of an upcoming announcement that commercial levels of gold are now being made from mercury and lead using a yet undisclosed cold fusion method, this article will conclude by offering possible reactions for these alchemical changes. Using simple hydron absorption by Pb or Hg, the following sample equations are:

(c)

$${}_{80}Hg^{200} + n^{*} \rightarrow {}_{79}Au^{197} + {}_{2}He^{4} + {}_{-1}e + \bar{\nu}, \quad Q=6.6\ MeV$$

(d)

$${}_{82}Pb^{204} + n^{*} \rightarrow {}_{79}Au^{197} + 2({}_{2}He^{4}) + {}_{-1}e + \bar{\nu}, \quad Q=8.6\ MeV$$

(e)

$${}_{82}Pb^{206} + 3(n^{*}) \rightarrow {}_{79}Au^{197} + 3({}_{2}He^{4}) + 3({}_{-1}e + \bar{\nu}),$$

Reactions such as (c), (d),and (e) could be termed Gold Fusion [12,13]. But whatever the name given, we know that all of the varied cold fusion methods now generating excess energy production or element transmutations mean complete vindication for Drs. Martin Fleischmann and Stan Pons, indeed for the entire Cold Fusion Family around the world. It is this author's view that the Battle is as good as won.

We might even say, "It's in the bag!"

References and Footnotes

1. E. F. Mallove, et al., "Radioactivity Remediation — The Cincinnati Group," *Infinite Energy*, Vol. 3, No. 13 and 14 (March- June 1997), pp. 16-28.

2. H. Fox, "Why Expect Neutrons?," *New Energy News*, Vol. 5, No. 4 (August 1997), pp.15-17

3. R.W. Bass, "Plasma Injection Transmutation, " *Elemental Energy* ("Cold Fusion"), No. 22 (July 1997), pp. 82-83.

4. "Eagleton's Theory of the CG's LENT Process," R. W. Bass, *Infinite Energy*, Vol. 3, No. 13 and 14 (March -June 1997), pp. 31-32.

5. H. Fox, "Charge Clusters In Operation," *Infinite Energy*, Vol. 2, No. 12 (Jan.-Feb. 1997), pp.62-63.

6. K. Shoulders, S. Shoulders, "Observations on the Role of Charge Clusters in Nuclear Cluster Reactions," *J. of New Energy*, Vol. 1, No. 3 (Fall 1996), pp. 111-121.

7. D. Moon, C. Bennett, "A New Cold Fusion Experimental Device," *New Energy News*, Vol. 5, No. 2 (June 1997), p. 4.

8. M. Twain, personal correspondence.

9. D. Moon, "Excess Heat versus Transmutations," Preprint, March 1997.

10. One of the factors to determine the fission mode of heavy metals might be the available proton flux. CETI's data for their thorium transmutation process (see *Infinite Energy* #13 and 14, pp. 14-15) feature the production of elements such as barium and zinc, which could be written:

$${}_{90}Th^{232} + 16(n^{*}) = {}_{56}Ba^{138} + {}_{30}Zn^{70} + 3({}_{2}He^{4}) + 14({}_{1}H^{2}) + 16({}_{-1}e + \bar{\nu}).$$

This reaction needs 16 protons (as hydrons). But in the CG's data, where Cu and Ti predominate as products, reaction (1) from Prof. Eagleton's theory [see ref. 4] requires 38 protons, and reaction (2) needs 45 protons. The CG's method brings in more protons around the thorium nuclei, resulting in more and smaller fission products.

11. J. Rothwell, "Summary Report on the Second International Low Energy Nuclear Reactions Conference," *Infinite Energy*, Vol. 2, No. 9 (July-August 1996), pp. 10-16.

12. It is noted that reactions (c), (d) and (e) absorb fewer protons (existing as hydrons): 1, 1, 3 respectively. This implies a very different reaction environment (active site) than that existing for the thorium transmutations of CETI and The Cincinnati Group. In the gold production, the proton flux is very much lower — perhaps only one or two proton chains oscillating in and out of a Pb or Hg atom at any instant.

13. Gold itself is transmutable, of course, and Dr. T. Ohmori, et al., discovered several new elements in their gold electrode after electrolyzing light water [see *New Energy News*, Vol. 5, No. 4, August 1997, pp. 9-10]. These include an abundance of iron with an unnatural ratio of Fe^{57} (20 times normal). Their iron production suggests at least some active sites in the Au electrode resemble the Cincinnati Group's—with pockets of large fluxes of swirling plasma protons breaking down the gold. For example:

$${}_{79}Au^{197} + 28(n^{*}) = 2({}_{26}Fe^{56}) + {}_{26}Fe^{57} + 2({}_{8}O^{16}) + 6({}_{2}He^{4}) + 27({}_{-1}e + \bar{\nu})$$

Prof. Ohmori also detected volcanic-like eruptions on the electrode surface. However, since these transmutations are, in this theory, mostly energetically bled by the escaping neutrinos, we are left with a possible option that bursts of fusion ignition created the local damage.

Cold Fusion
Chemically Assisted Nuclear Reactions
Electro-Alchemy
New Hydrogen Energy

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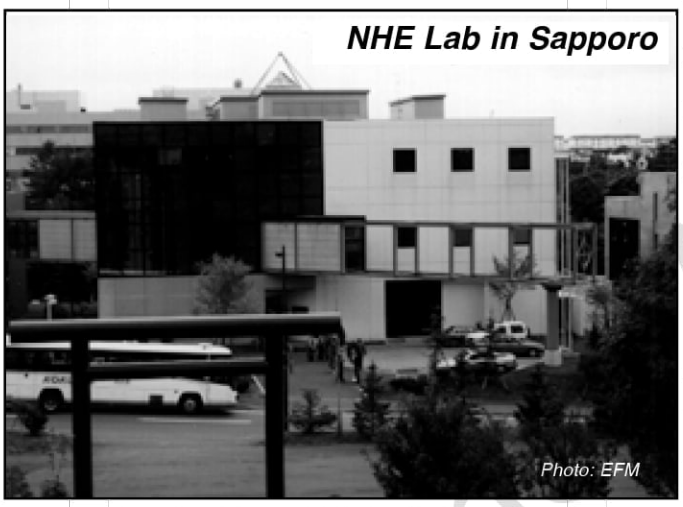
Official Japanese New Hydrogen Energy (Cold Fusion) Program to End— Missed Opportunities and Botched Management

Commercial Development and Research Continues and Accelerates in the US, Japan, and Elsewhere

by Jed Rothwell and Eugene Mallove

Infinite Energy Magazine has learned that the official Japanese cold fusion program (the New Hydrogen Energy Program), sponsored by Japan's MITI since 1993, will not receive continued funding beyond the spring of 1998. The *New York Times*, the *Nikkei* and Reuters have also reported that MITI intends to close down the New Hydrogen Energy cold fusion research program.



NHE Lab in Sapporo

Infinite Energy reported on the astonishing weaknesses of the NHE program in Vol. 2, No. 10, published after the Sixth International Conference on Cold fusion (ICCF6), which was held in October 1996 in Hokkaido, Japan. Contributing Editor Jed Rothwell pointed out several major technical problems with the research in his ICCF6 review and in An ***Open Letter*** to Japan's NHE Lab Directorate, written in Japanese and English, on page 28 of Issue #10. The letter includes 17 references to the literature, and it lists concrete problems with the protocols and materials used at the NHE lab, including low cell temperatures, improper cell and cathode materials, inadequate preparation and pre-testing of cathodes, and so on. These technical criticisms did not originate with *Infinite Energy*. They were suggested by Drs. Stanley Pons, Martin Fleischmann, John Bockris, Edmund Storms, T. Mizuno, Hideo Ikegami and the others cited in the footnotes. We pointed out that the French Atomic Energy Commission has successfully replicated the Pons-Fleischmann IMRA boil-off experiments (originally reported in *Physics Letters A*, 176 (1993) 118-129), because they were more careful about replicating every detail of the experiment, without making any changes.

The NHE is staffed mostly by scientists and engineers new to the cold fusion field. They are on 6 to 12 month assignments to the NHE lab. We urged the NHE researchers to pay more attention to the literature; to hire some electrochemists for the research; and to try the techniques suggested by these leading workers, but as far as we know, they have not done so. We did not receive any official response to the ***Open Letter***, nor did we expect any. Unofficially, NHE researchers denied that there is anything wrong with their techniques, and they refused to address any of the technical points in the ***Open Letter***. They accused us of plotting to bring down the lab in league with arch-enemies of cold fusion such as John Huizenga and Frank Close.

Let there be no misunderstanding: The prospective NHE closing has nothing to do with determining whether excess energy and low energy reactions are real or not. The evidence for excess heat and nuclear reactions at low energy is overwhelmingly established by numerous published peer-reviewed and non-peer reviewed papers and reports.

A MITI spokesman, quoted in news reports, pointed out that the $20 million spent on cold fusion was "was a pittance" compared with what is spent on other energy programs, like nuclear fast breeder reactors. Unfortunately, Japan's official NHE program could have had a major impact on the world's future in sustainable energy—eliminating not only the need for fossil fuels but dangerous and problem-plagued programs such as breeder reactors. Instead, the news about the NHE program, certain to be abused by critics of cold fusion—it already *has been* abused, will simply muddy the waters.

Let there be no misunderstanding: The prospective NHE closing has nothing to do with determining whether excess energy and low energy reactions are real or not. The evidence for excess heat and nuclear reactions at low energy is overwhelmingly established by numerous published peer-reviewed and non-peer reviewed papers and reports.

Excellent experimental continuing work that totally confirms the original cold fusion claims, and more, has been done in Japan. We cite, in particular the work of Drs. Yoshiaki Arata and Yue-Chang Zhang, which was recently the topic of a 56-page special issue of the journal of the *High Temperature Society of Japan*, "Solid State Plasma Fusion ('Cold Fusion')" Vol. 23, January 1997. This work has also been published in several papers in the *Proceedings of the Japanese Academy of Sciences*. Dr. Arata is an esteemed physicist who had been instrumental in Japan's hot fusion program.

Among other continuing activity in Japan, *Infinite Energy* has profiled the work of Dr. Mizuno on excess energy from solid state (solid proton conductor) cold fusion devices and established transmutation in metals of more conventional cold fusion devices. Drs. Ohmori and Enyo have obtained excellent excess heat results in light water systems. They have also observed and published evidence of metal transmutation phenomena. These scientists have been ignored in the official NHE program. In general, the NHE program has not given serious, appropriate attention to the excess energy phenomenon in light-water cold fusion cells, which is the preferred embodiment in many US-based efforts.

In the United States, commercial activity in cold fusion energy has accelerated

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beyond the Japanese work. Clean Energy Technologies, Inc. of Sarasota Florida (CETI), BlackLight Power, Inc. of Malvern, Pennsylvania, and ENECO of Salt Lake City—to name the more well-known efforts—are developing commercial heating and electricity generating devices. Several major utility companies have established investment positions within some cold fusion/new energy companies. The Cincinnati Group in Ohio has recently announced for sale a commercial demonstration device that transmutes radioactive thorium into benign nuclides in less than an hour. CETI, whose cold fusion heating devices have been profiled several times on ABC TV "Good Morning America" and "Nightline," also has a radioactivity reducing processes for which a United States Patent has been granted. A cold fusion and New Energy investment fund, *New Energy Partners*, has just been launched (see *Infinite Energy*, Vol.3, Issues #13/14 as well as this double issue.)

The New York Times, which influences all other science reporting in the United States, has regrettably *not* been covering progress in cold fusion research. Its last comprehensive report on cold fusion was on November 17, 1992, by Andrew Pollack, who is based in Japan. Mr. Pollack has not attended cold fusion conferences in Japan or anywhere else, but he was quick to report MITI's decision on the NHE program. *The Times* report was published on August 26, 1997, in an article titled "Japan, Long a Holdout, Ending Cold Fusion Quest." He states that the research "has failed to confirm that the phenomenon exists." This is a gross misunderstanding of the situation. We also point out that *New York Times* science reporter, William Broad, shown the work of Drs. Arata and Zhang by a representative of Dr. Arata, refused to report on it. Broad has previously (1991) written on accusations by cold fusion critics of alleged (and disproved) ethical violations by Drs. Pons and Fleischmann. While giving major attention to announcements of US hot fusion program achievements, Mr. Broad and his US-based colleagues have not covered cold fusion in the United States or Japan since his article in 1991.

The recent *Times* article by Pollack quotes Hideo Ikegami: "We couldn't achieve what was first claimed in terms of cold fusion. We can't find any reason to propose more money for the coming year or for the future." Jed Rothwell of *Infinite Energy* points out that hot fusion scientist Ikegami himself obtained positive results in his lab, which he transmitted to Rothwell. But Ikegami never published them, for reasons that remain unclear. Unless he is being misquoted by the New York Times, we do not understand why he is ignoring the many positive experimental results in Japan.

The *Nikkei* reported the NHE story on August 24, 1997. It quotes a MITI spokesman, "regrettably, we have not seen the effect in our experiments," but "we do not deny that the cold fusion effect exists."

To cite but a single example of the ineptitude of the official Japanese NHE program, let us discuss the absurd debacle at NHE in analyzing the Fleischmann-Pons boil-off experiment:

The Boil-Off Entrainment Problem

The *Yomiuri* quoted the NHE program manager:

> "In the Pons replication experiment, we saw excess heat and by the same token we saw examples of a heat deficit, where the energy appeared to vanish," explained program manager Naoto Asami, looking back over the work. "We found problems with their calorimeter, and we feel that their entire data set is weak and questionable."

No further details about the problems were described in the newspaper article, but in an Internet discussion group, Elliot Kennel, an American researcher now with the NHE who will be returning to the US, said there are huge flaws in Pons and Fleischmann's technique and data. He described these as "holes in the data big enough to drive a truck through." He cited this example:

> "In the case of boiling cells, we were able to verify that the electrolyte is entrained in the vapor column by measuring the pH of the condensate. Whenever excess heat was calculated, it was always due to overestimating the vapor mass transport. This is not to say that P&F did not have valid results. It may be that their equipment generates nuclear excess heat in France and false positives in Japan. All we can say is that our results, using their equipment, was susceptible to false positives, and for that reason we are not convinced by the data set which now exists. . . .
>
> "Anyway, for these reasons I believe that excess heat is at best elusive, and I'm no longer convinced that it exists at all. Mr. Rothwell claims to have some easy solutions, and I hope that he will soon convince some reliable laboratories to put them to the test. They might even work. But my view is that these laboratories also will become scapegoats when unambiguous results are not quickly obtained."

Kennel refers to the mass transport or entrained water problem. During a boil-off, if water leaves the cell as a liquid in unboiled droplettes, this invalidates Pons and Fleischmann's calorimetry, which is based upon the heat of vaporization of water. It takes a great deal of energy to vaporize water. It takes much less energy when foam or something else removes the water as droplettes. If you assume it was vaporized instead, you would greatly overestimate the energy during what looks like a boil-off. NHE researchers condensed the steam from the boil-off, and measured the acidity (pH) of the condensate. They found it contained lithium. This means that some electrolyte lithium left the cell in droplettes; the water was not perfectly distilled.

As long ago as ICCF4, Rothwell recalls that NHE researchers and others in Japan told him they suspected entrained water is a problem with the Pons and Fleischmann experiments. NHE researchers have circulated rumors about this, alluded to it during press conferences, and discussed it informally on Internet. *But they have never published a formal paper about it or discussed it at a conference.* They never told Pons or Fleischmann about their suspicions. When Rothwell brought up this subject with Martin Fleischmann, he expressed surprise. It was obvious from his reaction that he knew nothing about the NHE's statements. It is equally clear that the NHE researchers did not know that Pons and Fleischmann addressed this issue years ago. Miles, McKubre, Bockris, Fleischmann and others have repeatedly warned it can happen. Some heavy water supplies produce a lot of foam which can reach the top of the cell and expel unboiled electrolyte out of the cell. Miles and Fleischmann say they have identified the cause: heavy water can be contaminated with surfactants (surface-adhering chemicals, often used in detergents). Fleischmann explained to Steve Jones in September 1993:

> "One could say some of the D_2O is dispelled as droplets (actually, we recover ~95% of the alkali by dissolving the residues and titrating; some is undoubtedly lost by irreversible reactions with the glass walls of the Dewars.)"

Biberian told Jed Rothwell that the French AEC researchers check for entrained water by weighing a Kleenex tissue with a precision scale and placing it under the steam venting from the test tube. Entrained droplettes will fall onto the tissue. Melvin Miles comments on the problems of foam:

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". . . four experiments were all hindered by unusually large fluctuations in the cell voltages (±0.5 V) that were traced to a foaming problem in the D_2O-LiOD solutions. This foam would collect in the coils of the anode and then release. These four experiments all used D_2O supplied by NRL (Cambridge Isotope Laboratories, Lot No. PSO EH-283) and lithium foil supplied also by NRL (Alfa/Aesar Stock No. 10769). This shows that the D_2O can be an important uncontrolled variable in these experiments."

Foaming and entrainment are well-known problems. They must be checked for and prevented. They cannot explain IMRA Europe's results because Pons and Fleischmann did check for them and found no significant problem. Everyone knows that some entrainment will occur. A test tube does not make a perfect distiller. When this problem was first discussed years ago, Jed Rothwell remarked that he would never drink the distillate. (Lithium is highly toxic.) On the other hand, as far as is known, entrainment has never been observed to cause more than a minor error, no more than a few percent. We cannot imagine how it could carry off most of the water and cause 50% to 300% apparent excess, like that measured using boil-off calorimetry at IMRA and the French AEC. Rothwell asked Kennel how much apparent excess heat this artifact produced, but he did not respond. We suspect the NHE saw marginal artifactual heat, a few percent at most. They determined it was caused by entrainment and they decided to circulate the rumor than the same mechanism can explain Pons and Fleischmann's results too, as if foam could remove two-thirds of the water from the bottom of a tall test tube. Rothwell thinks the NHE researchers are casting about for a reason to discredit Pons and Fleischmann. They have not been able to replicate, so they want the world to believe there is nothing to replicate, it was all a mistake in the first place.

When Rothwell told Fleischmann about the NHE's entrainment hypothesis, his first response was the same as Rothwell's. He wondered, "do they claim you cannot distill water with a test tube?" For thousands of years, people have been distilling water and concentrating solutions by boiling small amounts at the bottom of a tall vessel. When they say they can explain "all of Pons and Fleischmann's results" the NHE is, in effect, claiming that this technique can fail catastrophically. If they could prove such a radical claim about an ancient technique, they would win a Nobel prize.

Fleischmann agreed that the NHE results were probably caused by foam, as others have observed. He pointed out another possible problem with the NHE set up. At various times when he visited the NHE lab, he noted that they added too much water to the cell, which raised the water line too high, which would greatly enhance entrainment. During open cell electrolysis, water continually leaves the cell. Every day or every few days, new water must be added. This is done with a syringe at the NHE, to avoid contaminating the heavy water by exposing it to air. The amount that leaves the cell can be computed by Faraday's law. Unfortunately, someone at the NHE made a mistake, and they began adding 4 ml per day instead of 2 ml. Fleischmann warned them about this, but they did not appear to fix the problem.

One section of the NHE Laboratory in Sapporo—Wasted Space? *—Photo: EFM*

Kennel also claimed there are significant problems with isoperibolic calorimetry:

". . . problems with boiling isoperibolic calorimetry, [add] another level of complexity . . . [W]e are also able to achieve 100% reproducibility of excess heat using Pons and Fleischmann's own ICARUS-2 boiling calorimetry cells (we use their cell, their palladium, their calorimeter). Unfortunately, here again we are quite sure that our positive results are due to flaws in the calorimetry, rather than to real excess heat."

Rothwell asked him whether he meant they have replicated the 300% excess heat and proved that it is an artifact. He did not respond. I asked him why the null boil-off experiments with platinum performed at IMRA Europe and the French AEC showed no excess. He did not respond. Rothwell asked him whether the NHE also performed null boil off experiments with platinum electrolysis or joule heaters to test their cell geometry and instruments, because it is highly unlikely that such an ancient technique does not work. He did not respond. His only reference to problems in the isoperibolic calorimetry was a reference to a paper: T. Saito et al., "Studies on the Pons-Fleischmann Calorimetry with ICARUS-1," *Proceedings ICCF5*, p. 105. He claims it proves there can be a 20% error in the calorimetry. However, this paper describes low-level heat detection, not the boil-off phase calorimetry. The Saito paper is over my head. Rothwell asked Fleischmann what he thought of it. He agrees that Saito showed a large error, but that is because the data set Saito chose is noisy. You can prove anything you like with this particular data. Fleischmann showed Rothwell two other samples of data from other runs at the NHE with much smaller random oscillations in the Y-axis. This data shows does not fit the Saito hypothesis.

Many things can go wrong in an experiment. A wet thermistor will produce a bogus reading. If your thermistor gets wet, you should not jump to conclusions, call a press conference and tell the *Yomiuri* Pons and Fleischmann must have had a wet thermistor and that explains why their experiment failed. You should first review the literature or ask them whether they checked for this problem. The NHE and other establishment labs do "science by press conference." First they attack a rival scientist in the mass media without revealing the technical reason for the attack; then they circulate rumors about the reason; then, much later (or never) they publish a paper describing the supposed problem. The problem they cite is orders of magnitude too small to explain anything, so they refuse to do a quantitative analysis. They pretend that a 3% error can explain away a 300% result. They wait until the public has forgotten the dispute and the rival's reputation is permanently damaged.

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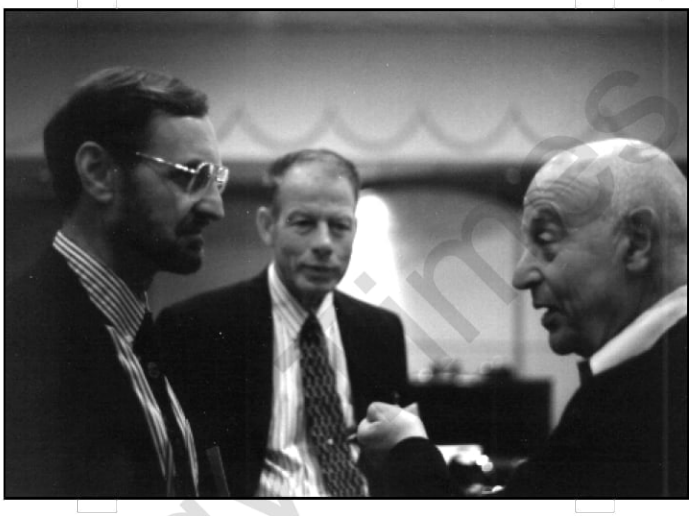
Introduction to the Cold Fusion Experiments of Dr. Melvin Miles

by Jed Rothwell

From 1989 until his funding was terminated in 1995, Dr. Melvin Miles performed some of the best cold fusion experiments on record. His goal was to answer two critical questions about the nature of cold fusion: Does it produce helium along with excess heat like a hot fusion reaction? If so, does it produce roughly as much helium per joule of energy as a hot fusion reaction does? He answers both questions affirmatively. When a cold fusion palladium cathode becomes active, it releases helium into the electrolyte. The helium leaves the cell in the effluent deuterium and oxygen gas. Cathodes that produced more excess heat produced greater amounts of helium. The ratio of helium to energy is roughly comparable to that of hot fusion, within an order of magnitude. This is strong evidence that cold fusion—at least *this* form of cold fusion—really is some form of nuclear fusion, and not fission, zero point energy, or something else.

Another important lesson from this research is that cathode material is the key to success. This is no surprise to people familiar with the literature, but Miles makes the trend clear. He tested 94 cathodes from 12 different sources. Seventeen out of 28 experiments with Johnson-Matthey palladium produced excess heat. All four of the special Johnson-Matthey cathodes provided by Fleischmann worked. But with 19 cathodes from four other batches, not one worked.

Miles is a professional, more willing to share information than anyone else in the field. He has published fifteen papers in conference proceedings and peer reviewed journals and a 98-page U.S. Navy report, which is abstracted in this issue. He has tried to publish more papers and letters, but most (*not all*) peer-reviewed mainstream journals turned him down. His lectures at the major cold fusion conferences have been models of clarity and rigor. He began research on helium detection in 1990, in collaboration with B. F. Bush [*Not to be confused with Professor Robert T. Bush at Cal Poly, Pomona —Ed.*.] and J. J. Lagowski at the University of Texas. Bush is an expert in dealing with contamination from air, a critical factor in this experiment. Samples of the effluent gas from the experiment were analyzed at the University of Texas. After the experiment had been underway for some time, samples were sent to the U.S. Bureau of Mines, which specializes in gas detection, and to Rockwell International. Similar results were obtained from both laboratories.



Dr. Melvin Miles (center), flanked by Dr. Michael E. Melich (left) of the Naval Post Graduate School, and Dr. Gustave K. Kohn, an ex-Chevron Corporation industrial chemist and executive. Meeting in 1995 at the Fifth International Conference on Cold Fusion in Monte Carlo, Monaco. ***Photo: EFM***

Miles was the first to perform a systematic search for helium in the effluent gas. He also looked for helium in the cathode metal, where researchers expected to find it at first. He and others have found only negligible amounts of helium in the metal. This indicates that the reaction occurs near the metal surface rather than in the bulk. After Miles published his findings, other researchers in Italy and Japan also looked for helium in the gas. Results have been mixed, but in recent work using the best, most sensitive equipment yet, Cignini and Gozzi have confirmed Miles's findings.[1]

Miles spent five months experimenting before he saw any excess heat. He was discouraged and ready to quit. Less dedicated people became discouraged after a few weeks of research. People may underestimate Miles, because he never makes a claim without extensive experimental evidence to back it up. He does not make the kind of exaggerated claims that have sometimes plagued this field. He has a low key, understated, matter-of-fact tone. He is always willing to discuss his problems and failed experiments. His final report includes a discouraging litany of experiments that produced no excess heat, month after month, years after the first successes. He says this is the most frustrating research he has ever done.

Why Helium is so Difficult to Detect

From the start many people suspected that cold fusion produces helium. Nobel laureate Julian Schwinger and other theoreticians predicted it should. Conventional plasma fusion (hot fusion) d-d reactions produce neutrons, tritium, gamma rays, and helium. Other hot fusion reactions are *aneutronic*; they produce no neutrons. When cold fusion was announced, people assumed that it must work the way hot fusion does, so they expected to find the same levels of these nuclear products. But it was soon obvious that cold fusion produces much more than millions of times fewer neutrons. Otherwise, a 1-watt cold fusion reaction would have killed the scientists observing the experiment. Cold fusion sometimes produces a low level of tritium; not as much as hot fusion, or the radiation alarms would go off and the health of the researchers might be endangered. Some devices are optimized to generate tritium, particularly Claytor's device at Los Alamos.

Neutrons and tritium are analogous to the smoke from a fire: some fires produce dense smoke, and some do not. We know how to reduce smoke by ensuring complete combustion. We have not yet learned how to control cold fusion neutrons. Unknown factors cause cold fusion reactions to produce very low level neutrons sometimes, and to become nearly aneutronic at other times, sporadically. It appears that helium may always be produced in proportion to the heat—at least in palladium/heavy water cold fusion systems.

If helium is always produced, you may wonder why so few other scientists have

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looked for it. And if neutrons and tritium are rarely produced, why did so many scientists devote such effort to find them? There are two reasons: scientists searched for neutrons out of habit, and because it is easy. Nuclear researchers are good at looking for neutrons and tritium. They all have detectors, and they know how to use them. Hot fusion reactions always produce neutrons in a predictable ratio to the energy. The neutron "signature" (the energy with which the neutrons strike the detector) tells the scientist a great deal about the reaction. Scientists look for neutrons and tritium because they are easy to look for, whereas helium is more difficult to detect. Hot fusion produces millions to hundreds of millions of times more neutrons per watt of heat than cold fusion, so the neutrons are easy to detect. You cannot miss them: as I said, the neutron flux from an unshielded 1-watt hot fusion reaction would kill the observer. With cold fusion, "heat is the principal signature of the reaction" (Fleischmann). It makes no sense to look for neutrons unless you are sure a reaction is underway, and the only way to be sure is to measure excess heat. Scientists who insist on looking for neutrons while they ignore helium and excess heat resemble the drunk who drops his keys in the bushes but looks for it under the streetlight because it is too dark to see in the bushes.

Helium is difficult to detect for four reasons:

1. It is not radioactive. Radioactive elements are easy to detect. You can detect a single atom of tritium at the moment it decays. You measure the solid angle of the detector to determine what percent of the beta particles (electrons from tritium decay) strike the detector. The beta particle signature distinguishes the tritium from other radioactive elements in the background and contamination. Based on the decay rate and the half-life you compute the number of tritium atoms left in the sample. The techniques are not easy to master, but an expert can determine how much tritium a sample has before, during and after an experiment. Helium-4, however, is a non-radioactive, stable atom. No instrument can detect a single atom of a stable isotope. A mass spectrometer makes a relative measurement of helium compared to some other element. You compare helium to a known amount of a carrier gas, usually nitrogen. (In other experiments, argon or krypton may be used as carrier gas, but Miles says they are usually contaminated with helium, so nitrogen is a better choice.) The helium is mixed with the carrier gas and the sample is placed in the spectrometer. The spectrometer registers parts per million (ppm), or parts per billion (ppb) of helium compared to carrier gas. You extrapolate from this to estimate the total helium in the full sample. This method is problematic and indirect compared to measuring radioactive isotopes. Radioactive isotopes are measured in absolute numbers. Non-radioactive isotopes are measured relative to the carrier gas.

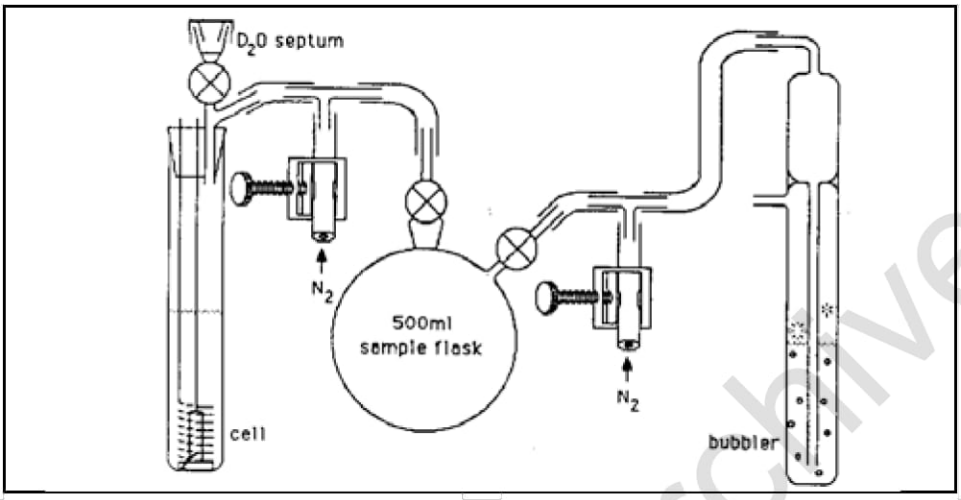

Figure 1.-Electrolytic cell with positive pressure gas discharge line used to collect samples of effluent gas.

Miles also calculates the helium generated per watt of power per second. This is the basis of his claim that the helium is commensurate with a plasma fusion reaction.

2. Helium-4 has nearly the same mass as a deuterium molecule (D_2) (4.02820 amu versus 4.00260 amu). Two thirds of the effluent gas from electrolysis is deuterium gas (D_2). Only 9 parts per billion are helium. It takes a high resolution mass spectrometer to tell them apart. With lower resolution the helium may be indistinguishable, or it might appear as a blurred "shoulder" rather than a separate peak. The effluent gas is processed to filter out most of the deuterium.

3. Helium contamination is ubiquitous. Helium constitutes 5.4 parts per million of the atmosphere at sea level, and it will slowly permeate glass, rubber, plastic and other materials. Contamination cannot be easily eliminated. It must be measured and accounted for in control experiments and runs that did not produce excess heat. Miles' control experiments consistently measured background helium contamination ranging from 3.4 to 4.9 ppb. The mean value was 4.5 ± 0.5 ppb, which is remarkably consistent. Most of this background helium probably diffused through the rubber connection between the cell and the collection flask. When excess heat was generated, the level of helium increased significantly, always in proportion to the heat. With the cell that generated the most heat, helium doubled, to 9.7 ppb. These numbers are the heart of the studies.

4. Both hot fusion and cold fusion produce fantastically small amounts of helium. Miles has pointed out that a 1-watt fusion reaction would take 73,000 years to produce a single mole (4 grams) of helium. The collection flask takes an hour and fourteen minutes to fill (4,440 seconds). In later experiments, using metal flasks, Miles saw only low power, typically around 0.060 watts (60 milliwatts). At this rate the collection flask should have approximately 5×10^{-10} grams of helium from fusion in it, or 7×10^{13} atoms. After subtracting background contamination, Miles found approximately 2×10^{13} atoms per flask, an extraordinarily close result.

How the Experiment is Performed

Miles uses an open cell with static, isoperibolic calorimetry. This is the simplest possible arrangement. The anode and cathode are placed at the bottom of a tall test tube (the cell). The temperature of the electrolyte is measured with a thermistor. The cell is calibrated by heating the electrolyte with the joule heater at different power levels, and with electrolysis with palladium and light water, or palladium at the beginning of the experiment when no heat is being produced. Static calorimetry is more precise than flow calorimetry. It has higher resolution, that is, it can show fine gradations of tens of milliwatts with more confidence than a flow calorimeter. It is less complicated; it does not require pumps, tubes, flowmeters, and two thermistors. The disadvantage is that a static calorimeter is more dependent upon calibrations made before

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and after the run. A flow calorimeter is a first principle device which is theoretically not dependent upon the calibrations. In actual practice any calorimeter must be extensively calibrated, but some skeptics argue that a static calorimeter might depart from its calibration constant during a run without anyone noticing and then mysteriously return to it before post-experiment recalibration is performed. Nothing like this has ever happened as far as I know. Flow and static calorimeters can drift or go wrong in various well-known ways. The biggest problems with static calorimeters are changes in the bath temperature (or room temperature with an air-cooled cell), and a large change in electrolyte level when gas leaves the cell and the water is not replenished.

The term "open cell" means the effluent gas from electrolysis leaves the cell. Some open cells vent the gas directly to the air, but Miles directs the gas through a bubbler to prevent helium and light water contamination. In a closed cell, a recombiner combines the free oxygen and deuterium gas in the head space to make heavy water again.

Miles collects the effluent gas from the cell into a stainless steel flask. He ships the flask to another laboratory for analysis. The setup is shown in Figure 1. The flask is purged with nitrogen which has been checked to ensure it does not contain measurable levels of helium. It is attached to the cell and left in place for two days. The system is "self-flushing." Effluent gas comes in one side of the flask, fills it, and goes out the other side. It passes through a bubbler, which creates back-pressure. This keeps the gas pressure in the cell, flask, and tubes a little higher than the surrounding air, so that any leaks will go out, not in. During the two days the flask is attached to the cell, enough effluent gas passes through to fill it forty times. Then the stopcocks are turned off. The flask is sealed and removed from the cell. It is transported to another laboratory with a high resolution mass spectrometer. The setup in the second laboratory is shown in Figure 2. The gas is passed through a two-stage filter to remove gases other than helium. The remaining gas then enters the mass spectrometer where the helium is measured. This description gives you a sense of how demanding the work is:[2]

> Strenuous efforts were made to avoid contamination of the effluent gas from the electrolytic cell with any external source of helium. . . . Two identical systems were always run simultaneously using calorimetric cells as described previously. Connections between the cell, flask, and oil bubbler employed thick-walled rubber vacuum tubing. All connecting lines, as well as the cell, were flushed vigorously with boil-off nitrogen, which contained no ^4He (see Table 1), for at least 10 min prior to attaching a gas collection flask. Furthermore, the flasks were generally connected to the cell for at least two days of D_2O electrolysis before removal. The gas evolution rate was calculated to be 6.75 ml min^{-1} at 528 mA (200 mA/cm^2) and 700 Torr assuming ideal gas behavior; thus the 500 ml collection flask was further flushed with more than 19 times its volume of evolving D_2 and O_2 gases per day. Actual measurements of the gas evolution rate by the displacement of water yielded 6.75 ± 0.25 ml min^{-1} for cell A and 6.69 ± 0.15 ml min^{-1} for cell B. All solvent additions were made only after vigorously sparging the make-up D_2O with nitrogen for about 5 min. The D_2O was always added through the septum and stopcock into the cell using a gas-tight syringe (Hamilton No. 1005).

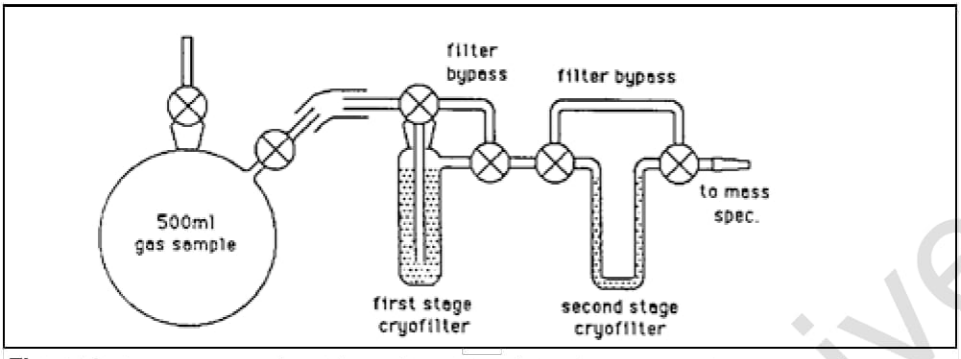

Figure 2.-The two-stage activated charcoal cryofilter, designed to remove all gases except helium.

Advantages of an Off-line Spectrometer

At first glance, collecting the gas in one location and analyzing it another seems clumsy. It invites errors, possible confusion between different flasks, and contamination while the flasks are in transit and waiting to be tested. Gozzi prefers to use a helium detection system attached to the cell that measures helium as it is generated: on-line, in real time. The off-line helium detection in this study was criticized. Skeptics claim this is a weakness for a variety of reasons, but mainly because helium will seep into the flasks during the delay between collection and analysis. They claimed that helium will readily penetrate glass so the data from glass flasks cannot be trusted. Miles and his co-workers took this criticism to heart. They switched to stainless steel flasks and established that background contamination was accurately measured. They were able to repeat the helium-4 production results using these metal flasks.

Miles was forced to do off-line analysis because the mass spectrometer in his laboratory does not have sufficient resolution to easily distinguish between helium and deuterium molecules. He made a virtue of necessity. He took advantage of off-line detection to reduce costs, improve reliability, and bolster confidence in the results. Cost is reduced because the mass spectrometer is the most expensive instrument needed for this experiment. An on-line spectrometer must be dedicated full time to cold fusion for the duration of the experiment, which may be months or years. When samples are tested off line the spectrometer is only needed for a day or two every few months. Other researchers use it most of the time.

An on-line spectrometer can be a weak link in an experiment. Mass spectrometers are finicky, high tech machines. They are reliable when used in ordinary applications, but in this case they were stretched to the limits of their capabilities. They had to be calibrated and adjusted frequently. Before he tested each new flask, Bush calibrated for helium and fine-tuned his spectrometer. A physics experiment is a running battle with the instruments. Graphs often contain gaps and dotted lines representing times when the data was lost because of one failure or another. Cold fusion itself is a sporadic, unpredictable effect that "usually turns on for two hours starting at 3 a.m. on Sunday night when nobody is around to see it," as Bockris says. When your detection equipment may also drop out of service for hours or days at a time, you have little chance of capturing a complete, continuous heat burst. Either the cold fusion or the mass spectrometer will be broken on any given day, or if they are both working the computer will be out, the thermocouple interface will be flaky, there will be a leak in the hose somewhere, or something else will go wrong. With off-line processing the reliability of the spectrometer does not matter. The flask of sample gas sits on the shelf while the technicians tinker with the

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instruments.

Off-line processing allows blind testing, which eliminates unconscious bias and bolsters confidence in the results. Miles labeled the flasks with arbitrary codes. (He selected birth dates of his family members.) The people operating the mass spectrometer did not know whether the samples came from control tests, dud runs that produced no excess heat, or excess heat runs. They did not know whether Miles expected to find excess helium or not. His hopes cannot interfere with their objectivity.

Possibilities for Error

When excess heat was generated using metal flasks, the amount of helium generally rose to between 7 and 9 ppb, roughly double the background. The mass spectrometers used in this study can detect ±1.1 ppb, so this is significant. It is 4 to 5 sigma in the best cases. But the error bars are large. The amounts of helium generated by cold fusion are infinitesimally small, as you would expect if it is a nuclear reaction. The data requires sophisticated processing, extrapolation to determine the helium content of the full sample, and corrections for background helium. The small numbers and complex analysis are unavoidable, but they raise doubts and they require careful study.

Above all, we want assurance that this increase of 4 ppb is not merely contamination. Air contains 5,400 ppb of helium. A tiny bit of air leaking into the cell could easily double contamination from 4 to 8 ppb. Actually, it would probably increase it a hundred or a thousand times. How can we be sure these increases really are correlated with heat? How do we know they are not random fluctuations from contamination? Miles presents a sophisticated statistical analyses. Let us consider this problem from a non-mathematical, common sense point of view. If the helium came from air contamination, the results would not be consistent. The control runs and runs that did not produce excess heat would not all show the same narrow range of helium. Helium would not increase with excess heat. It would not correlate with the level of excess heat. Contamination would produce random levels of helium, probably far higher than what was detected in these experiments. It is difficult to imagine a direct air leak that always lets in a tiny level, at or below 4.6 ppb. An air leak would sometimes let in tens and sometimes thousands of ppb, at random. It is even more difficult to imagine an air leak that doubles when and only when cells produce excess heat. Tiny background levels like 4.5 ppb characteristically come from helium gradually seeping in through rubber or plastic. In the control experiments the helium background always remained within a narrow range of 3.4 to 4.6 ppb. When cells produced excess heat, helium always rose above this narrow range, and it increased in proportion to the heat.

Could the heat itself have caused a tiny increase in diffusion, perhaps by changing the permeability of the rubber? No, because some of the dud cells were run at higher overall power than the heat-producing cells. Electrolysis power levels during dud runs were raised and lowered considerably, from a half-watt to two watts, with no measurable effect on the helium background. Furthermore, the rubber tubing was outside the cell at room temperature.

Could the helium be random despite appearances? Is it only apparently correlated with heat? Is the range of background values, 3.4 to 4.6 ppb, too wide to be meaningful? The answers can be found in the statistical analyses by Miles. One is particularly simple. Each experiment is reduced to a presence or absence test. Helium below the background 4.6 ppm is "absent," anything above that is "present." In Appendix C, Miles describes the statistical test:

> For our 33 experiments involving heat and helium measurements, excess heat was measured in 21 cases and excess helium was observed in 18 studies. Thus 12 experiments yielded no excess heat and 15 measurements gave no excess helium. If one uses these experimental results as random probabilities of P_h = 21/33 for excess heat and P_{He} = 18/33 for excess helium, then the probability of random agreement (P_a) for our heat and helium measurements would be . . . 0.512, and the probability of random disagreement (P_d) would be . . . 0.488. The presence or absence of excess heat was always recorded prior to the helium measurement and was not communicated to the helium laboratory. [The "blind test" procedure.] Based on our experimental results, the random probability of the helium measurement correlating with the calorimetric measurement is not exactly one-half. This is analogous to flipping a weighted coin where heads are more probable than tails. The probability of exactly three mismatches in 33 experiments, therefore, would be . . . 1.203×10^{-6} . . .
>
> The total probability of three or less mismatches in 33 studies would be . . . 1/750,000 . . .
>
> Furthermore, it is very unlikely that random errors would consistently yield helium-4 production rates in the appropriate range of 10^{11} - 10^{12} atoms/s per watt of excess power . . .

Dramatic Differences in Palladium from Different Sources

Miles found that palladium from different sources has dramatically different performance. Cathode material is the most important variable in these experiments. Here is a summary of Table 10 :

Source	Success Ratio (excess heat / total tests)
NRL Pd-B alloy	7/8
Johnson-Matthey (J-M) Pd	13/24
J-M from Fleischmann	4/4
NRL Pd (first batch)	1/2
Tanaka Pd (sheet)	1/3
NRL Pd (another batch)	0/4
NRL Pd-Ag	0/3
IMRA Japan Pd-Ag	0/2
WESTGO Pd	0/6
Pd/Cu	0/2
John Dash Pd (sheet)	0/2
Co-deposition (1992)	2/34
Total:	28/94

Most of the samples produced 1 to 2 watts per cubic centimeter. One of the J-M samples produced 15 watts/cm^3, and in 1994 one of the J-M cathodes from Fleischmann produced 14 watts/cm^3. Contrary to the claims of Jones and other critics, Miles observed high levels of heat in the middle and latter stages of his research project, when he used improved, more sensitive calorimeters. Miles observed heat from Johnson-Matthey palladium wire. Samples of wire from the same spool were later tested in the improved China Lake calorimeter developed by Kendall Johnson, and other samples were tested by Wilfred Hansen at Utah State University. Excess heat was confirmed in these tests.

Other researchers who have tested palladium from different sources also report that the best samples come from Johnson-Matthey. Fleischmann says the best palladium is a special grade available from Johnson-Matthey in 2-kilogram lots for $20,000 (not £20,000 as we reported earlier).[3] Miles discusses some of the morphological and metallurgical differences between working and non-working palladium. Storms describes them in greater detail.[4] March 1996.

Power Density Standard

Miles often quotes the performance of his cathodes in power density: watts per cubic centimeter. He points out that his power density of about 1 watt/cm^3, and many

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1989 era experiments could not have detected such low power in their own cells, given the size of their cathodes and the sensitivity of their instruments. He says that if the calorimeter cannot detect this level of excess power, then the experiment should not be performed. Storms[5] cautions that this standard can be misleading: It might be understood to mean that the reaction is a product of the entire bulk of palladium metal, occurring uniformly throughout the metal. Storms says that was the initial assumption made by Pons and Fleischmann, but it was a mistake, which led to poor experimental approaches. Everyone, including Pons and Fleischmann now believe that the reaction occurs in small active sites in the metal, probably near the surface. The spotting on autoradiographs and the localized areas of transmutation found by Mizuno[6] and Minevski[7] support this hypothesis. Pons and Fleischmann originally used small cathodes with large surface area compared to the bulk. Since the reaction probably occurs near the surface this geometry makes their power density numbers look comparatively good, but the comparison makes no sense.

I do not think Miles intended the power density standard to express a specific hypothesis about the origin of the heat. He meant that given the state of the art of cold fusion research in 1989, and assuming that cathodes in different labs had roughly similar geometry, a researcher should have been prepared to detect the level of heat that Miles, Pons and Fleischmann and others saw at that time: about a watt per cubic centimeter. Miles feels that unless the calorimeter is accurate to ±20 mW or better, it is probably a waste of time to do calorimetric experiments on cold fusion. Miles did not mean that was the upper limit of power. His own cathodes sometimes produced much higher power density after 1989, and so did cathodes in other labs. He knew he was nowhere near the limit of the power producing capacity of the metal. Nobody has ever mapped out these limits. Storms thinks that the power density of the hot spots within the metal might be well over 10^6 watts/cm^3.

His political problems began with the DoE ERAB (Energy Research Advisory Board) Cold Fusion Panel report. This report, compiled in the summer of 1989, concluded that cold fusion is a mistake. It cited Miles' work as an example of a quality experiment that found no excess heat or nuclear products. At the time the report was compiled this was true. Miles worked for five months without success. Later, after he began to observe heat and helium he contacted the ERAB report authors and pointed out that his findings no longer supported their conclusions and their report is now obsolete. They ignored him.

There is no better illustration of the fact that the ERAB report began as a rush to judgement and degenerated into a cover-up.

Precise Calorimetry Required

Miles uses small cathodes, and they do not produce much excess heat compared to some of the leading cold fusion experiments. He is forced to measure low levels of excess heat, ranging from 50 to 500 milliwatts. He would like to see more power, but these are the best results he has been able to achieve. In order to measure such low power with confidence, he and his colleagues have improved the cell hardware to the point where it is now one of the most precise electrolysis calorimeters in the literature. They can now achieve ±1% or ±10 mW resolution (whichever is larger) over a wide range of temperatures. The best flow calorimeter is McKubre's as SRI, which measures ±25 mW over a narrow range of temperatures. (See "Improved China Lake Calorimetry.") Miles uses sophisticated equations to account for temperature dependencies and room temperature changes. He has written a definitive paper on isoperibolic electrolysis calorimetry. One of the most important lessons from this paper, it seems to me, is that at low power levels the apparent cell constant changes radically. It is not linear. This is shown in Figure 5 from that paper, "Effect of power level on the apparent cell constant (K) and heat transfer coefficient (h)." Miles shows how this led to errors in the negative cold fusion experiment at Cal Tech: "The neglect of the intercept term in eq 4 produces significant errors in the apparent cell constant for power levels below about 0.6 W. All of the calorimetric data reported by Lewis et al are near or below a total power level of 0.6 W; hence his use of the approximate relationship P .)T/h is likely a large source of error." I believe this nonlinear response may explain some of the positive results with the gigantic input to output ratios seen with nickel cathodes at very low power. Below a half-watt, a simple linear equation will not work with this type of cell. This does not mean that small gradations in power cannot be detected. With a linear approximation you can measure the difference between 1.010 watts accurately, and you can easily distinguish it from 1.040 watts. At the low end of the scale you will think that 0.020 watts are 0.050.

Political Problems

Melvin Miles is quiet, dignified, and as Martin Fleischmann says, thoroughly honest. He was a university professor before coming to the Navy. He is not a disputatious person. He does not exaggerate or argue for the sake of arguing. He does not enjoy politics and controversy, the way people like Preparata and I do. However, because his work is so good, and his critiques are so well crafted, he has drawn fire from the opposition. Over the years he has become embroiled in some nasty political fights with extremists in the Department of Energy (DoE), CalTech, MIT, Harwell, Brigham Young University, and finally in the Navy itself. He was even criticized for working on this final report too long and too earnestly. His managers asked him to wrap it up quickly and drop the subject. As he puts it, he attracts flak for doing the job right.

His political problems began with the DoE ERAB (Energy Research Advisory Board) Cold Fusion Panel report.[8] This report, compiled in the summer of 1989, concluded that cold fusion is a mistake. It cited Miles' work as an example of a quality experiment that found no excess heat or nuclear products. At the time the report was compiled this was true. Miles worked for five months without success. Later, after he began to observe heat and helium he contacted the ERAB report authors and pointed out that his findings no longer supported their conclusions and their report is now obsolete. They ignored him.

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There is no better illustration of the fact that the ERAB report began as a rush to judgement and degenerated into a cover-up. Several months before Miles, Bockris, McKubre and other serious researchers finished their first round of experiments, the ERAB report was signed and sealed and the *New York Times*, *Nature*, the American Physical Society and the rest of the scientific establishment already condemned cold fusion as delusion, fraud and mendacity.

Miles wrote one of the best short guides on calorimetry with an electrolytic cell.[9] He discussed many common problems, especially the changing electrolyte levels, when the temperature is measured in the cell. As water is electrolysized in an open cell, the electrolyte level falls and the apparent cell constant increases. A watt of power might raise the temperature of the cell 4°C when the electrolyte level is high, but as the level falls and the mass of water decreases, and a watt might raise the temperature 5°C instead. As the water level falls, less electrolyte touches the cell wall, so a smaller area of the outside cell wall transfers heat, which also raises the apparent cell constant. Pons and Fleischmann minimized this problem by using a half-silvered Dewar cell, which confines most of the heat transport to a window below the waterline. Miles minimized the electrolyte level effect by integrating the heat in a compartment outside the cell and measuring the cell temperature at that location.

Not only does the apparent cell constant change as the water level falls, but the electrolyte becomes more concentrated, impedance falls, and the cell consumes more power. Every few days the experimenter has to replenish the cell with new heavy water. This causes a sudden jump in impedance and a large fall off in power. Miles has to adjust for these and other factors, like the loss of heat from the top of the cell. As he puts it, "there is no steady state during D_2O + LiOD electrolysis experiments for either cell voltage or cell temperature." He shows how to do an exact numerical analysis to take into account all of the major factors in this changing system. He suggests that if a scientist does not to do this level of sophisticated analysis, he should at least calibrate the cell at different water levels. "Approximate solutions require, at very least, an experimental evaluation of the terms involved in the time dependency of the cell temperature, cell voltage, and cell contents in order to justify the omission of any of these terms." Miles focuses on: "a critical analysis" of "several key publications that have impacted on this scientific topic." In plain English, he describes some large errors in the famous so-called negative cold fusion papers in 1989, from CalTech, MIT and General Electric. He shows that the cells at CalTech and MIT did, in fact, generate excess heat, but the researchers did not realize it because they botched their analysis.

The mistakes made by Lewis et al. at Cal Tech are surprisingly simple. To start with, Lewis did not calibrate his cell in the normal sense of the word. That is, he did not test it with a joule heater, a dummy platinum cathode, or light water and palladium. Instead, he put the "live" palladium sample that he planned to test for excess heat into the cell, and calibrated with that cathode as the experiment began. He ran electrolysis at a given power level until the temperature stabilized, then he noted the temperature, stepped up the power level and noted the new temperature. This is a peculiar way to do an experiment. To 'calibrate' means: "determine by comparison with a standard." Lewis did not use a known standard; he compared the palladium with itself. Suppose the "live" cathode began producing heat soon after the experiment began, before Lewis finished calibrating? How would he know? As Mallove puts it, you don't stand on the bathroom scale when you set it zero.

Suppose the "live" cathode began producing heat soon after the experiment began, before Lewis finished calibrating? How would he know? As Mallove puts it, you don't stand on the bathroom scale when you set it zero.

Lewis' method worked, despite being sloppy and unconventional. He succeeded in calibrating on the fly with live palladium. Some people, including Storms,[5] even recommend this method today, because when you replace a dummy platinum cathode the slight change in position may affect the cell performance. Storms, however, has the advantage of hindsight. We now know that palladium—heavy water cold fusion does not generally produce heat for the first few days. That was not a safe assumption to make in 1989. In any case, Lewis got a good calibration. Not only that, but he soon saw evidence of excess heat, although he denies it. When the experiment began, input was 0.464 watts and the ΔT was 6.5°C. The cell constant was 14.0°C per watt. Five days later Lewis input 0.595 watts. The ΔT should have been 8.4°C, but it was up to 9.4°C, an entire degree hotter than expected. (One degree Celsius measured with laboratory grade instruments is a large temperature change.) There must have been 0.07 watts of excess heat. Yet Lewis reported there was no excess, and he still says there was none. If there was no excess heat, the cell constant mysteriously moved up from 14.0°C to 15.8°C per watt. As Miles puts it: "This 26% increase in heating coefficients, based on our experience, is highly unusual. Closer examination, however, shows that Lewis et al. erroneously define the heating coefficient at $h = \Delta T/PT$ where the total power (P_T) is the sum of the electrolysis power and resistor power. According to Newton's law of cooling, the temperature difference, ΔT, defines the total power from the cell to its surroundings; thus any excess power (P_X) must be included in defining the total power. This neglect of P_X by Lewis et al. in the equation defining h would lead to an increase in the heating coefficient as the excess power increases."[9]

Lewis never gave a reason for this alleged change in the heating coefficient. He never said it was caused by thermocouple drift or lower electrolyte level or some other gross error. It would have to be a gross error; a subtle one would not cause such a large discrepancy. He did not admit he made any errors at all. In fact, he will not even admit he claims the cell constant changed! *Nature* asked him whether they should publish a critique by Noninski & Noninski explaining his mistake. (*Nature* allowed cold fusion skeptics to accept or reject publication of letters criticizing their work. This may be the first scientific debate in history where one side gets to choose what the other is allowed to say.) In a muddled private letter to *Nature* editor David Lindley, Lewis explained:

> While it is true that our open system measurements were not sensitive to any current-density independent excess heat (as clearly stated in our original *Nature* manuscript), Pons and Fleischmann clearly stated in their work that they only observed current-density dependent excess heat. Our original experiments would have readily detected this heat; we clearly did not see such excesses . . . N&N have now also proceeded to invent a new hypothetical type of heat which they claim could have been missed in our experiments, and which was not reported by Pons and Fleischmann in their experiments. . . .

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Actually, the Noninskis and Miles claim the heat was missed in his equations, not his experiments. It shows up in the experiments as clear as a bell. I think Lewis means that if the excess had been exactly proportional to current density alone, and completely controlled by current density, then he would have detected the heat, so he doesn't have to worry about apparent changes in the cell constant, apparent violations of Newton's Law of Cooling and stuff like that, which he thinks are characteristic of "a new hypothetical type of heat." To my knowledge, Lewis has never addressed the issue and never tried to explain exactly why the temperature was 1°C hotter than it should have been. Instead he brags that he proved cold fusion does not exist, and he goes around saying that cold fusion scientists do sloppy work.

Frankly, I find it hard to believe that an experienced electrochemist like Lewis could make such an obvious mistake in the first place, and I find it impossible to imagine that he has never read any of the letters mailed to him and published in the journals. He must know he made a mistake, yet he refuses to retract. Prominent establishment skeptics still say the negative experiments at the "big three," CalTech, MIT and Harwell, were the nails in the coffin of cold fusion. Yet Miles, Noninski, Swartz, Fleischmann, Melich and others have demonstrated that all three of these experiments produced excess heat. Since the experiments were performed by people who wanted to kill cold fusion as quickly as possible, and who later obfuscated and denied their own results, in a sense you can say these experiments were the best proof from 1989 that cold fusion is real. (Experiments from later years were far better than anything in 1989.)

Miles also pointed out that Lewis attempted to detect helium from the reaction with a mass spectrometer that was only capable of measuring parts per million, not parts per billion. Any production of helium would not likely be detectable at that sensitivity.

Miles pointed out several problems with MIT, especially the fact that they ignored changes in electrolyte level.

Political Problems with Steve Jones

Steve Jones invited Miles to lecture at Brigham Young University in 1991. When Miles tried to present his experimental results, he was repeatedly interrupted. His 50 minute presentation took three hours to complete. Jones has had a vendetta against Miles ever since. He wrote letters to journals and Internet news groups repeating the same misinformation and unscientific claptrap again and again. Miles was finally forced to send a formal objection, because, he explained, he had an obligation to defend his reputation and the quality of work at a U.S. Navy laboratory:

> Professor Steven E. Jones of Brigham Young University has been aggressively attacking my scientific publications involving the Fleischmann-Pons effect (cold fusion) for almost two years and has recently accused me of rejecting heat/helium data points and fudging my results. I highly resent such unfounded attacks since they damage my professional integrity as a scientist as well as reflect on the quality of research conducted at Navy laboratories. Navy scientists are required to submit their work for review and clearance before any manuscript can be released for publication.[12]

Here are some examples of the objections raised by Jones. He says that with better calorimetry and higher resolution mass spectroscopy, the excess heat and helium evidence disappeared. The published experimental data show this is not true. Jones also claimed that data was deliberately withheld, despite the fact that Miles has explained repeatedly that this supposedly "withheld" data was accidentally left out of one early paper and published in all subsequent papers. Jones claims the excess heat was caused by recombination of the effluent gas. Yet, Miles measured the effluent gas flow carefully, and saw no sign of significant recombination. The effluent gas was the main focus of the experiment, so it was measured repeatedly. Miles also points to extensive studies in the literature that show "no recombination (depolarization) effects were observed with fully submerged palladium cathodes run at high currents."

Jones raises a host of nit-picking objections, which often backfire on him. Here is part of a debate between Jones and Miles:

Jones Query 2(a): Lee Hansen noted that RTV (silicone rubber) which you used to seal the calorimeter against moisture is not a reliable barrier. (Reference: Polymer Permeability, 1. Comyn, ea., Elsevier, 1985.) He also notes that vermiculite used as insulation is unusual and may itself contribute to moisture problems in the calorimeter. If the moisture content in the insulation changes, or moves, this will affect thermal conductivities and flow paths, in turn changing thermal "constants," and decreasing the reliability of your calorimeters.

Actually, the Noninskis and Miles claim the heat was missed in his equations, not his experiments. It shows up in the experiments as clear as a bell. I think Lewis means that if the excess had been exactly proportional to current density alone, and completely controlled by current density, then he would have detected the heat, so he doesn't have to worry about apparent changes in the cell constant, apparent violations of Newton's Law of Cooling and stuff like that, which he thinks are characteristic of "a new hypothetical type of heat." To my knowledge, Lewis has never addressed the issue and never tried to explain exactly why the temperature was 1°C hotter than it should have been. Instead he brags that he proved cold fusion does not exist, and he goes around saying that cold fusion scientists do sloppy work.,

Miles' Response: Any penetration of moisture into the insulation of our calorimeter would produce an increase in the calibration constant (WPC). No such increase has been observed experimentally. Our calibration constants in Table 3 show no time relationship over a one-year period.

In an early experiment, water was accidentally injected into the insulation. This produced a marked increase in the cali-

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bration constant that made this calorimetric cell unusable. Although our sealant is not in direct contact with water, it is the same that is used as caulking in bathrooms and showers to seal against moisture.

The use of this moisture argument by Lee Hansen to explain our excess heat effects would require the insulation to become drier during the experiment while the cell is submerged in the water bath. This violates common sense as well as the Second Law of Thermodynamics.

Like many skeptical objections, this one:

1. Cannot happen;
2. Did not happen, as the data shows;
3. If it did happen, it would be the skeptic's own problem; it would bolster the cold fusion claim.

In another example, Jones brings up the issue of helium diffusing through glass. He asks Miles to review the data for different glass flasks and compare it to the duration the flask was stored. Miles points out that the flasks which sat in storage longest were among those that showed the least amount of helium.

Termination of the Navy Program and Political Fallout

The Navy program ended in 1995 because the reproducibility problem could not be solved and because of the lack of any positive results at the Naval Research Laboratory (NRL). Miles is always polite, but he does not sugarcoat his evaluations. He got in trouble with the management at the Navy for criticizing the NRL in statements like this in his final report:

> The second approach that hindered progress was the extended focus on NRL Pd-Ag and Pd cathodes. The deuterium loading was poor for these materials, hence excess-heat production was not likely. This is exactly what was observed by our calorimetric experiments. Success with NRL materials was finally achieved for Pd-B alloys, but these results apparently came too late to save this program. Even the NRL Pd-B materials often showed folded-over metal regions or other flaws that would likely act as cracks and prevent high loadings. Our calorimetry generally yielded excess enthalpy when palladium samples that yielded excess heat at other laboratories were tested and never yielded excess heat when samples that contained flaws or that showed poor loading characteristics were tested.
>
> Some comments are necessary concerning the major disappointment that no excess power was measured in experiments conducted at NRL (Reference 36). The calorimeters at NRL were modified into a larger design to permit loading studies. This obviously changed the scaling of the cell, which is an important factor in these experiments (Reference 5). Furthermore, the room temperature control was very poor in the laboratory at NRL. Finally, the data acquisition system used at NRL did not average the cell potential. This large error source (±5%) is discussed on page 9. These factors led to a reported error of ±200 mW or larger (±10%) in experiments at NRL (Reference 36). Any excess power effect at NRL would have to be at least 600 mW to be clearly beyond experimental error. The excess-power effects observed at China Lake during this program would not have been detectable at NRL.

These statements do not strike me as strident or insubordinate. Nobody has denied the technical accuracy of the statements, and nobody can deny that they describe serious problems. Voltage changes rapidly in an electrochemical cell, mainly because of bubbles. The cell voltage increases as bubbles collect on the electrode, then drops when bubbles disengage. Thus, the cell voltage is constantly fluctuating. At the NRL, voltage was read once every six minutes. This means they took 240 random samples per day. The standard technique for measuring a rapidly oscillating value like the voltage in an electrochemical cell is to take hundreds or thousands of samples over a minute, average them, and store this average value once a minute or every few minutes. I do not understand how a scientist could overlook the averaging technique. It is built into the canned software that comes with data collection instruments and add-on computer boards. It is described in textbooks, user manuals and even magazine advertisements.

His willingness to speak the truth got Miles into trouble with management. He feels this was precipitated by his criticism of the NRL experiments. Scientists at big laboratories sometimes get the idea that they have nothing to learn from people at smaller labs, or retired scientists like Storms who work in their own basements. The NRL made many changes in their calorimetry system without consulting with Miles, hence their calorimetric error became very large. Is Miles too outspoken? I find nothing objectionable in this report. No scientist should get in trouble with management for pointing out things like a 5% error caused by not averaging voltage, or errors caused by large fluctuations in ambient air temperature. It is a scientist's professional responsibility to point out such problems.

Footnotes

1. F. Cellucci et al., "X-ray, heat excess and ^{4}He in the electrochemical confinement of deuterium in palladium," *Proc. Sixth Internat. Conf. on Cold Fusion*, NEDO, Institute of Applied Energy, 1996

2. B. F. Bush et. al, "Helium production during the electrolysis of D_2O in cold fusion experiments," *J. Electroanal. Chem.*, 304 (1991), 271-278

3. C. Tinsley, "Testing the Ragland Triode Cell," *Infinite Energy*, # 13 and 14, 1997, p. 55.

4. E. Storms, "How to Produce the Pons-Fleischmann Effect," *Fusion Technology*,

5. E. Storms, private communication, October 1997

6. T. Mizuno, "Reaction Products Induced by Isotopic Changes of Electrolysis," *Infinite Energy*, Issue 4, p. 9.

7. Z. Minevski, "Two Zones of 'Impurities' Observed After Prolonged Electrolysis of Deuterium on Palladium," *Infinite Energy*, combined issues 5 and 6, p. 67.

8. Energy Research Advisory Board. "Cold Fusion Research," A Report of the Energy Research Advisory Board to the U.S. Department of Energy, November 1989

9. M. Miles, B. Bush, D. Stilwell, "Calorimetric Principles and Problems in Measurements of Excess Power during Pd-D_2O electrolysis," *J. Physical Chemistry**, 1994, 98, 1948-1952

10. M. Swartz, "Some Lessons From Optical Examination Of The PFC Phase-II Calorimetric Curve," Proc. Fourth International Conference on Cold Fusion, 1993, Vol. 2, p. 19-1

11. M. Melich, W. Hansen, "Back to the Future, The Fleischmann-Pons Effect in 1994," *Proc. Fourth International Conference on Cold Fusion*, 1993, Vol. 2, p. 10-1

12. M. Miles, Letter to Steven E. Jones, June 9, 1993

13. "Cold Fusion Experimenter Miles Responds to Critic," *21st Century Science* magazine, Spring 1992, p. 76.

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ANOMALOUS EFFECTS IN DEUTERATED SYSTEMS

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SEPTEMBER 1996

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FOREWORD

This work was funded by the Office of Naval Research (ONR) as a collaborative program with the Naval Research Laboratory (NRL) and the Naval Command, Control and Ocean Surveillance Center-Naval Research and Development (NCCOSC-NRaD).This is the final report of the research performed at the Naval Air Warfare Center Weapons Division (NAWCWPNS) on anomalous effects involving deuterated palladium and palladium alloys. This report examines the possible production of excess power, helium-4, tritium, and radiation during the electrolysis of heavy water (D_2O) using palladium and palladium alloys as cathodes.

This report describes work supported by the Office of Naval Research and has been reviewed for technical accuracy by Richard A. Hollins and John D. Stenger-Smith.

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ABSTRACT

(U) [unclassified] Excess power was measured in 28 out of 94 electrochemical experiments conducted using palladium or palladium-alloy cathodes in heavy water. Reproducibility continues to be the major problem in this controversial research area. Based on our experiments, this lack of reproducibility stems from unknown variables in the palladium metal. The best reproducibility for excess power was obtained using palladium-boron materials supplied by the Naval Research Laboratory. Our basic isoperibolic calorimeters were capable of measuring excess power with a sensitivity of ±1% of the input power or ±20 mW, whichever was larger. Calorimeters that are capable of detecting excess power levels of 1 watt per cubic centimeter of palladium are essential for research in this field. Results from our laboratory indicate that helium-4 is the missing nuclear product accompanying the excess heat. Thirty out of 33 experiments showed a correlation between either excess power and helium production or no excess power and no excess helium. The collection of the electrolysis gases in both glass and metal flasks place the helium production rate at 10^{11} to 10^{12} atoms per second per watt of excess power. This is the correct magnitude for typical deuteron fusion reactions that yield helium-4 as a product. Anomalous radiation was defected in some experiments by the use of X-ray films, Geiger-Mueller counters, and by the use of sodium iodide detectors. There was never any significant production of tritium in any of our experiments.

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EXECUTIVE SUMMARY

Our results provide compelling evidence that the anomalous effects in deuterated systems are real. Nevertheless, we have not been able to solve the reproducibility

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problem. This research area will remain highly controversial until reproducibility can be demonstrated. The lack of reproducibility stems mainly from unknown and uncontrolled variables in the palladium stock. There is a remarkable correlation of excess power with the source of the palladium. The best reproducibility was obtained using palladium-boron (Pd-B) materials supplied by the Naval Research Laboratory (NRL), Washington, DC. Seven out of eight experiments that used Pd-B cathodes produced excess power. In experiments that used the palladium from Johnson-Matthey, 17 of 28 experiments produced excess heat. In contrast there were several palladium sources that never produced excess power in any experiment. Our calorimetric results, conclusions, and problems are practically identical to those reported by the SRI International (SRI) Energy Research Center, Menlo Park, California. They are also consistent with many other laboratories that have reported excess heat. Calorimeters that are capable of detecting excess power levels of 1 watt per cubic centimeter (W/cm^3) of palladium are essential for research in this field. The small volume of palladium in co-deposition experiments likely made it difficult to detect excess power effects.

Results from our laboratory indicate that helium-4 (^{4}He is used interchangeably with helium-4) is the missing nuclear product. Thirty experiments have shown a correlation between either excess power and helium production or no excess power and no excess helium. Studies using both glass and metal flasks place the ^{4}He production rate at 10^{11} to 10^{12} atoms per second per watt (atoms/s•W) of excess power. This is the correct magnitude for typical deuteron fusion reactions that yield helium as a product. It is highly unlikely that our heat and helium correlations could be due to random errors. The only valid experiments that showed significant excess power but no excess helium involved a palladium-cerium (Pd-Ce) cathode.

Our best experiments produced up to 30% excess heat, 0.52 watts of excess power, and 1400 kilojoules (kJ) of excess enthalpy. This amount of excess enthalpy is difficult to explain by any chemical reaction. We have demonstrated that any recombination of the deuterium (D_2) and oxygen (O_2) electrolysis gases in our experiments can be readily detected and easily corrected. There was never any measurable recombination when the palladium cathodes were fully submerged in the deuterium oxide plus deuterated lithium hydroxide (D_2O + LiOD) electrolyte.

Anomalous radiation was detected in some experiments by the use of X-ray films, several different types of Geiger-Mueller (GM) counters, and sodium iodide (NaI) detectors. Normal radiation counts were always observed when no electrolysis experiments were running. The appearance of anomalous radiation always correlated with the expected rate of loading of the palladium with deuterium. Nevertheless, the anomalous radiation effect was not reproducible.

There was never any significant production of tritium in any of our experiments. A few experiments, however, suggested low levels of tritium production.

INTRODUCTION

This Office of Naval Research (ONR)-sponsored program began in January of 1992, involving the Naval Air Warfare Center Weapons Division (NAWCWPNS, formerly Naval Weapons Center (NWC)), Naval Command, Control and Ocean Surveillance Center-Naval Research and Development (NCCOSC-NRaD), San Diego, California (formerly Naval Ocean Surveillance Center (NOSC)), and the Naval Research Laboratory (NRL), Washington, DC. However, there was considerable research on this topic conducted at China Lake prior to 1992. This research will be summarized in this report. A considerable portion of the China Lake results has been published in refereed scientific journals and conference proceedings. These published results will be briefly summarized and referenced; copies of these articles are available from the author.

The objective of this program was to answer two basic questions:

1. Is the apparent physical effect real?
2. If so, can it be reproduced regularly?

In our opinion, the answer to the first question, based on this research, is <u>yes</u>, but the answer to the second question is <u>no</u>. The lack of reproducibility has made this research exceedingly difficult and frustrating. The only consolation is that no other research group in the world has been able to solve the reproducibility problem. Given that the excess heat effect is real, this will never be a useful energy source until the reproducibility problem is solved.

Most scientists hold the view that anomalous effects in deuterated metals can be explained by experimental errors. Some scientists go so far as attributing positive results to self-deception and even fraud and consign this phenomena to the realms of Langmuir's "Pathological Science." Due to the lack of experimental reproducibility, this field remains practically defenseless against such attacks. To our knowledge, no laboratory can provide detailed experimental instructions to another laboratory and guarantee the reproduction of the excess heat effect. Nevertheless, considerable knowledge has been gained concerning experimental conditions that favor the excess heat effect. Later in this report, we will provide a detailed description of procedures, based on our experiments, that favor the anomalous production of excess power. However, our experiments indicate that the lack of reproducibility is due largely to unknown and uncontrolled variables contained within the palladium stock. Studies by M. McKubre et al. at SRI have led to this same conclusion (Reference 1).

Many scientists attribute reports of excess power production in these experiments to calorimetric errors. However, it is nearly impossible to explain how calorimetric errors could lead to practically identical results between independent laboratories. For example, the major conclusions from the China Lake calorimetric experiments are almost identical to those reported by M. McKubre et al. at SRI (References 1 and 2). The excess power measurements in the China Lake experiments can be summarized by the following conclusions:

1. The excess power effect is typically 5 to 10% larger than the input power. The largest excess power effect was 30%.

2. The excess power in terms of the palladium volume typically yields 1 to 5 W/cm^3.

3. Long electrolysis times are required before the onset of the excess power effect. This time period usually ranges from 6 to 14 days of electrolysis.

4. Excess power production requires a threshold current density of 100 milliamperes per square centimeter (mA/cm^2) or larger.

5. Most experiments produced no evidence of any excess power. Overall, only 30% of our experiments yielded evidence for excess power.

6. Our success ratio in obtaining excess power varied greatly with the source and batch of palladium used.

The SRI results typically yielded 5 to 10% excess power with a maximum of 28% excess power; the excess power in terms of the palladium volume was 1-5 W/cm^3 on the average; the initiation time was on the order of 300 hours (h) for 1-to 4-millimeter (mm) diameter Pd wires; the threshold current density ranged from 100 to 400 mA/cm^2; and the success rate varied greatly with the source of the palladium (References 1 and 2). This striking agreement between the China Lake and SRI results simply cannot be explained by calorimetric errors. Furthermore, the calorimeters used at China Lake and SRI are totally different. China Lake used an open, isoperibolic calorimetric system (References 3 and 4) while SRI employed a closed, isothermal flow calorimetric design (Reference 2).

The China Lake calorimetric results are also very similar to those reported by M. Fleischmann et al. (Reference 5) when the excess power density (W/cm^3) in terms of the palladium volume is compared with the experimental current density. Both China Lake and M. Fleischmann (Reference 5) report approximately 1 W/cm^3 of palladium at current densities of 100 to 200 mA/cm^2 (see Figure 4 of Reference 6). In a review by E. Storms (Reference 7), the China Lake calorimetric excess heat effects are shown to be very similar to those reported by many other laboratories.

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The calorimetric results reported by China Lake have been used to support both sides of the scientific controversy regarding anomalous effects in deuterated metals. Our first set of experiments conducted over a 6-month period (25 March-7 September 1989) produced no significant evidence for any excess enthalpy production (Reference 3). These early experiments at China Lake were listed in the Energy Research Advisory Board (ERAB) report to the U.S. Department of Energy as one of the groups not observing excess heat (Reference 8). The groups from Massachusetts Institute of Technology (MIT), Cambridge, Massachusetts; California Institute of Technology (CalTech), Pasadena, California; and Harwell Laboratory, Oxfordshire, United Kingdom, also reported no evidence for excess heat (Reference 8), thus greatly impacting the general scientific opinion regarding this field. All three groups discontinued their experiments after only a few months of investigation. We continued to investigate other palladium samples and eventually observed significant evidence for excess enthalpy from the use of Johnson-Matthey palladium rods (References 4 and 9). In retrospect, it would be impossible for any research group to adequately investigate the multitude of variables involved with this field in only a few months. These variables range from the palladium metallurgy to the D_2O purity, the type of electrolyte and concentration, the electrochemical cell, the electrode arrangement, the type of calorimeter, proper scaling of the experiments, the handling of materials, the current densities used, the duration of the experiments, the loading of deuterium into the palladium, the use of additives, and so on. The investigation of some of these variables has been reported by McKubre et al. (References 1, 2, and 10). We will discuss our conclusions regarding many of these experimental variables in this report.

CHINA LAKE CALORIMETRY

Our measurements of excess power that will be presented in this report will not be accepted by other scientists until they are convinced that the calorimetric measurements are correct. This problem is compounded by recent publications by S. E. Jones et al. (References 11 and 12) that attack claims of excess heat production in "cold fusion" experiments. This attack features a detailed examination of publications from our laboratory (Reference 11). We will refute many of the issues raised by Jones regarding our work in this report. A response has been submitted to the *Journal of Physical Chemistry*.

Considerable progress has been made in our understanding of calorimetric principles and problems since our initial studies in 1989. Our present understanding of open, isoperibolic calorimetry involving the electrolysis of D_2O + LiOD is detailed in a recent publication (Reference 13). There is no steady state in these experiments since D_2, O_2, and D_2O vapor continually exit the cell in the gas stream; thus the LiOD concentration steadily increases and the cell voltage decreases (see Figure 2 of Reference 13). The addition of D_2O to replenish the amount lost by electrolysis and evaporation is generally made at the end of the day.

The equation governing the time-dependent behavior of our calorimeter can be expressed as

$$(E(t) - \gamma E_H)I + P_x = a + K\Delta T + P_{gas} + P_{calor} \qquad [1]$$

where P_x represents any excess power (Reference 13). The rate of enthalpy transfer outside the cell due to the D_2, O_2, and D_2O gas stream (P_{gas}) is given by

$$P_{gas} = \frac{\gamma I}{F}\left\{\left[0.5C_{P,D_2} + 0.25C_{P,O_2} + 0.75\left(\frac{P}{P^* - P}\right)C_{P,D_2O(v)}\right]\Delta T + 0.75\left(\frac{P}{P^* - P}\right)L\right\} \qquad [2]$$

and the time dependence of the enthalpy of the calorimeter is given by

$$P_{calor} = C_{P,D_2O(l)}\left[M^\circ - (1+\beta)\frac{\gamma I t}{2F}\right]d\Delta T / dt - (1+\beta)\frac{\gamma I}{2F}C_{P,D_2O(l)}\Delta T \qquad [3]$$

The symbols in these equations are defined in Reference 13. These expressions are essentially the same as those reported by Fleischmann et al. (Reference 5). The current efficiency for D_2O electrolysis (γ) was always determined to substantiate any measurements of excess power (Reference 14), thus claims by Jones et al. (References 11 and 12) that recombination of D_2 and O_2 gases within the electrochemical cell can explain the excess heat production are without foundation.

Equations 1 through 3 are actually much more complicated than they appear since the treat capacities (C_{P,D_2}, C_{P,O_2}, $C_{P,D_2O(v)}$), the partial vapor pressure of the D_2O solution (P), the enthalpy of evaporation for D_2O (L), and the thermoneutral potential (E_H) are expressed as empirical equations that define their numerical values over the experimental temperature range. These empirical equations used in our calculations are given in Appendix A. Our calculations, therefore, are based on the actual cell temperature rather than on some arbitrary standard state temperature. Equation 1 becomes a complicated, nonlinear, inhomogeneous differential equation when the time-dependent expressions for P_{gas} and P_{calor} are incorporated (Reference 13).

We have presented a critical analysis for the key calorimetric publications from CalTech, MIT, and Harwell based on our Equations 1 through 3 (Reference 13). Despite the fact that it was the calorimetric results from CalTech, MIT, and Harwell that convinced most scientists that the excess power effect did not exist, nobody has challenged the validity of our Equations 1 through 3. All three of these major laboratories that reported no excess power assumed steady state conditions for their electrolysis experiments and incorrectly defined the cell output power simply by $K\Delta T$ (Reference 13). In fact, our analysis of the CalTech calorimetric results indicates excess power as large as 76 milliwatt (mW) at 140 mA/cm^2 (Reference 13). This corresponds to 1.0 W/cm^3 of palladium and is in excellent agreement with our results.

As pointed out by Jones and Hansen (Reference 11), we have also used simplified calorimetric expressions in some of our early publications (References 3 and 4). Although P_{gas} and P_{calor} vary significantly with current (I) and the electrolyte concentration, their sum remains positive and less than 0.020 W for our range of experimental conditions. Therefore, neglecting the sum P_{gas} + P_{calor} in Equation 1 will only <u>underestimate</u> our value for P_x (Reference 13). This conclusion may not be valid for other designs of isoperibolic calorimeters. Our calorimeters are unusual due to an outer water jacket that surrounds the cell and acts as an integrator of the heat output of the cell (References 3 and 4).

As should be expected, our calorimetry has improved with time. An early version had glass tubes containing the thermistors that protruded considerably above the tops of the cells (Reference 4). Although the effect of these thermistor tubes was not apparent when the room temperature was stable, cooler weather later produced greater fluctuations in room temperature and unstable thermistor readings. This was especially apparent in a water (H_2O) control study (Figure 6 of Reference 4). In the following experiments, the thermistor tubes were made flush with the cell top, resulting in much more uniform measurements. Although Jones and Hansen (Reference 11) focused considerable attention on Figure 6 of Reference 4, they ignored our explanation and correction for this effect (see pp. 245-246 of Reference 4). A dramatic improvement in the calorimetric stability is seen in the experiment following the H_2O control study (see Figure 7 of Reference 4) where the single-tail t test for excess enthalpy easily exceeds the 99.95% confidence level (see Table 2 of Reference 4).

A major error source for our calorimetry is the flow of heat out of the top of the cell that is affected by the room temperature (Reference 13). At constant bath (27.50°C) and room temperature (23.50°C), it can be shown that the flow of power from the cell to the room and to the bath is given by

$$P = K_t(T_b - T_R) + K\Delta T = a + K\Delta T \qquad (4)$$

where $K = K_b + K_t$ (References 13 and 14). From experimental evaluations of K_t and

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K, it can be shown that a ±1.0°C change in room temperature produces a ±20 mW error in our calorimetric measurements. A theoretical correction for changes in either the room (T_R) or bath (T_b) temperatures is given by

$$\Delta T = \Delta T_{obs} + K_t K^{-1}(T_b - T_R - 4) \qquad (5)$$

where ΔT_{obs} is the observed difference between the cell and bath temperatures. For calorimetric cells A and B, $K_t K^{-1}$ is experimentally determined to be 0.15 while for calorimetric cells C and D that use insulated caps, $K_t K^{-1}$ is 0.05. From Equation 5, a ±1°C change in T_b-T_R produces a ±0.15°C error in)T_{obs} for cells A and B. For a cell constant (K) of 0.14 W/°C, the ±0.15°C error in ΔT provides an error of ±0.021 W using P = KΔT. All calculations involving Equations 1 through 3 also involved the correction expressed by Equation 5. The deviation of Equation 5 is given in Appendix B. Except for seasonal changes in our heating and cooling system, our laboratory room temperature was generally maintained within ±1°C of 23.5°C.

Accurate calorimetry requires extensive averaging of the cell potential, E(t), which fluctuates due to the evolution of gas bubbles from both the anode and cathode surfaces. These voltage fluctuations were generally about ±0.1 volt (V), but this varied with the current, electrolyte type and concentration, cell geometry, electrode arrangement, and any solution foaming problems. We continuously monitored the cell potentials using strip chart recorders and averaged the voltage over approximately a 10-minute (min) interval during measurements. Calibrations were always performed exactly the same as other measurements to minimize errors. Due to the time constants of our calorimeters (25 to 30 min), see Reference 14), ΔT in Equation 1 was also a corresponding time-averaged measurement. The averaged cell potentials were generally measurable to within ±0.01 V or ±0.5%, whichever was larger.

The accuracy of our calorimetry is illustrated in Figure 1 that features an experiment that never displayed any evidence for excess power. The measured output power ($a + K\Delta T + P_{gas} + P_{calor}$) tracks very closely to the electrochemical input power as expressed in Equation 1. Another experiment that produced no excess power is displayed in Figure 2. The ratio, X, of output power and input power calculated from Equation 1 remains close to unity. Approximately 70% of our experiments displayed no evidence for excess power and served as controls for our calorimetry.

The use of Equations 1 through 3 along with the room temperature correction (Equation 5) yields an error range of ±20 mW or ±1% of the input power (whichever is larger) for our isoperibolic calorimetry. This compares favorably with the SRI flow calorimetry where excess power below 50 mW is judged to be indiscernible (Reference 1). The noise level in the SRI calorimetry is generally ±95 mW (References 1 and 2). Initially, in developing our calorimetry, we concluded that excess power effects below about 50 mW would not be of interest. However, more accurate calorimetry is required in measuring small power effects related to the loading of deuterium into the palladium and in examining events that trigger or kill small excess power effects. An improved calorimeter recently developed at China Lake that can accomplish these tasks is described in the next section.

In June of 1995, Roger M. Hart, founder of Hart R and D Inc., Mapleton, Utah, and an expert in the design, construction, and testing of calorimeters, visited our laboratory at China Lake. After carefully examining our calorimetric design and techniques, he agreed with our stated error range of ±20 mW or ±1% of the input power, whichever is larger. This is especially true over our normal operating temperature range of 40 to 60°C for the cell temperatures. At higher temperatures, nonlinear effects such as heat transported by radiation become larger. The P_{gas} term (Equation 3) also rapidly becomes larger at high cell temperatures due mainly to increased evaporation of D_2O. The effect of the cell temperature on the P_{gas} term is shown in Figure 3. Furthermore, the loss of H_2O from the integrating jacket becomes a problem at high cell temperatures. At low cell temperature, the fraction of heat lost through the top of the cell becomes larger (see Equation 4). This becomes especially noticeable for cell power levels below 0.6 W (see Figure 5 of Reference 13).

A major criticism presented by Jones and Hansen (Reference 11) of our calorimetry is the variation of the calorimetric cell constants over various experiments. For example, K_1 ranges from 0.135 to 0.141 W/°C over four separate experiments that yield a mean of 0.138 ±0.003 W/EC (Reference 4). Roger Hart pointed out that this criticism by Jones and Hansen is not valid since all cell components are repositioned in each experiment. The relative positions of the anode and cathode electrodes and of the two thermistors vary somewhat with each new cell assembly, thus the slight variation in the calorimetric cell constants in different experiments is expected.

IMPROVED CHINA LAKE CALORIMETRY

Based on our previous experience with integrating open, isoperibolic calorimeters, improvements were recently made to eliminate most of the error sources. This new calorimetry and improvements are illustrated in Figure 4. The major new improvements include a copper (Cu) inner jacket that acts as the integrator and replaces the H_2O jacket. An insulating box over the cell top and bath greatly reduces the effect of changes in the room temperature. Furthermore, the lead wires coming out of the cell are thermally staked to the bath itself, thereby further reducing the effect of the room temperature. A copper outer jacket contacts the bath and minimizes bath level effects by virtue of its high-thermal conductivity. Foam insulation is used between the two copper jackets. Active cooling of the bath provides excellent temperature stability even at high-input power to the cell.

Perhaps the major improvement is the data acquisition system used with this new cell design. This provides extensive averaging of the cell voltage, cell temperature, and all other readings that are then compiled into a measurement every 5 minutes. This steady collection of data provides for the tracking of events that may trigger the excess power effect. Two calorimeters of this improved type are run in series, and six experiments were completed. This new calorimeter yields accurate results for cell temperatures ranging from the bath temperature to near boiling temperatures. This significantly extends the operating cell temperature range of 40 to 60°C for our previous calorimetry.

The ability of this new calorimeter to measure the heat of absorption of deuterium into palladium is shown in Figure 5. A power output of approximately 6.5 mW is observed for 2 hours. This yields 47 J that compares very favorably to the expected 44 J based on the cathode size (1 mm x 4.3 cm), a loading level of $PdD_{0.6}$, and using the reported value of - 35,100 joules/mole (J/mol) D_2 (Reference 14).

The noise level for this improved calorimeter is only ±0.2 mW or ±0.1% of the input power, whichever is larger. This is considerably better than any other electrochemical calorimetric design that we have seen. For comparison, the noise level in the SRI experiments using flow calorimetry is ±25 mW (References 1 and 2). The absolute accuracy as determined from silver cathode control experiments is ±1% or ±10 mW (whichever is larger) over the entire temperature range covering 0 to 5 W of input power.

Examples of several small episodes of excess power from a palladium cathode used in this improved calorimeter will be presented later in this report. Apparently, this new calorimetry can be used to study events that may trigger or kill the excess power effect. A patent application is being prepared based on this new calorimeter design.

CHINA LAKE RESULTS PRIOR TO 1992

Results from our laboratory from 1989 to 1992 are documented in the literature, hence they will be only briefly summarized in this report. Initially, no excess heat was observed in various experiments, but excess heat was eventually measured in

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later experiments when another source of palladium was tested.

Our early studies in this field were mainly a learning experience. No excess heat effects were observed over the time period of March to September of 1989 (Reference 3). In retrospect, many errors were made that minimized our opportunities for observing any anomalous effects. Similar learning-experience errors were likely at CalTech, MIT, Harwell, and other laboratories that reported no excess heat for their 1989 experiments. The major error was that most of our experiments were simply not run long enough to expect an initiation of the excess power effect. Furthermore, the palladium used was from a single source (Wesgo) and of unknown purity. Our calorimetry results are listed in the November 1989 report of the Energy Research Advisory Board to the U.S. Department of Energy that evaluated early cold fusion research (Reference 8). We are listed with MIT, CalTech, Harwell, and other laboratories as groups not observing excess heat. Our best set of measurements yielded an average ratio of power out to input power of X = 1.00±0.04 (Reference 3). Critics of this field cannot accept these early results from our laboratory and then simply reject or ignore our later calorimetric reports of experiments producing excess power.

Between September 1989 and March 1990, five out of six Pd-D_2O + LiOD experiments produced statistically significant amounts of excess enthalpy (References 4 and 9). The same two palladium rods (Johnson-Matthey) were used in each experiment. Two Pd-H_2O + lithium hydroxide (LiOH) control studies that used these same cathodes failed to produce the excess heat effect (References 4 and 9). These H_2O control studies were conducted between the second and third set of experiments in D_2O + LiOD that produced excess power. The H_2O studies ended on 25 December 1989, and the palladium cathodes were idle until the next D_2O + LiOD experiments began on 8 February 1990. Hydrogen contamination of the palladium was apparently not a problem since excess power was again observed for both cathodes after a few days of electrolysis (see Figure 7 of Reference 3). Results were internally much more consistent for these two experiments than observed in the H_2O studies since the thermistor tubes were now flush with the cell tops (Reference 4). The highest confidence levels for excess enthalpy using the single-tail t test were obtained in this third set of Pd-D_2O + LiOD experiments (see Table 2 of Reference 4). The excess enthalpy easily exceeded the 99.95% confidence level (Reference 4).

Some comments on the Pd-D_2O + LiOD experiments conducted between September 1989 and March 1990 may be useful since these studies yielded one of our highest success rates for excess enthalpy production. The following experimental conditions may have been important in obtaining the excess heat effect:

1. The same two palladium cathodes were used in each set of experiments. This supports the concept that the palladium metallurgy is a critical variable. Furthermore, heat-producing cathodes can be successfully reused in following experiments.

2. One palladium cathode failed to produce statistically significant excess heat in its first experiment, but excess heat was observed in the second and third D_2O-LiOD experiments using this cathode. This suggests that the loading and deloading of the palladium with deuterium may help to induce the excess heat effect.

3. The connection between the palladium cathode and the nickel lead wire was always made by spot welding. Solder was rarely used in our experiments.

4. The nickel lead wire used for the cathode was covered with heat-shrinkable Teflon tubing, and the spot weld was masked with clear epoxy (Epoxipatch No. 0151). This minimize any direct contact of nickel with the solution. Furthermore, this nickel wire was under cathodic protection during these experiments. McKubre et al. (Reference 1) report a strong, deleterious effect on loading when nickel is used as the anode.

5. The anodes were constructed completely of platinum (Pt)-20% Rh. No other leads were connected. Platinum is generally used as anodes and for connections to the Pd cathodes in these experiments, but we did not have Pt wire of the required diameter (0.1 cm) available at the time.

6. The electrochemical cells were washed thoroughly using Alconox detergent and then rinsed with copious amounts of water and distilled water. No acetone or other organic solvents were used. These cells were always placed in a vacuum oven overnight or longer prior to use.

7. The electrolysis cells were not sealed, hence the gases vented directly into the atmosphere. Rubber stoppers were always used for the cell tops. In later experiments involving helium analysis, the cells were sealed with silicon rubber and the gases were vented through an oil bubbler. There may have been contamination from both the silicon rubber and the mineral oil in the bubbler. It may have been better to have vented the gases through a D_2O bubbler and then through the oil bubbler. Sealing the cells minimized H_2O and carbon dioxide (CO_2) contamination from the atmosphere but may have added acetic acid and other species from the silicon rubber.

8. The same lot of D_2O was used in these experiments (Cambridge Isotopes, 99.9% D). Later experiments that used a new lot of D_2O were less successful despite the use of cathodes cut from the same palladium rod.

9. The same lithium source (ROC/RIC, 99.95%) was used in making up the 0.1 molar (M) LiOD solutions. These solutions were prepared a few days prior to the start of the experiments and stored in brown glass bottles (empty D_2O bottles).

10. A current of 264 mA was switched between anodic and cathodic polarities about 10 times over a 20-minute period prior to starting the experiments.

11. A cathodic current density of 100 mA/cm^2 (264 mA) was applied from the beginning and throughout the experiment.

Since these experiments later became much less reproducible, it has been impossible to unravel the importance of each experimental variable. Nevertheless, it is our opinion that the selection of the palladium cathode material is the most critical step. Nothing else seems to matter if the palladium cathode material is not suitable. Exactly what constitutes a suitable palladium material remains to be defined. The absence of cracks, surface inclusions, and damage is apparently important (Reference 1). The grain size of the palladium and the presence of impurities, such as boron, may also be important.

Except for calorimetric calibration studies, no further experiments were conducted involving this topic until October 1990. The objectives of these new experiments were to determine if helium is produced during excess heat events, to test for neutron activation of gold and indium foils, and to investigate higher current densities (200 to 250 mA/cm^2). These experiments in calorimetric cells A and B used the same two palladium cathodes as before, but the LiOD concentration was increased to 0.2 M to accommodate the higher currents. Nevertheless, the current density was set at 100 mA/cm^2 at the beginning and ranged from 50 to 100 mA/cm^2 for the first 12 days of the experiment. Normal calorimetric behavior was observed during this period, and no excess heat was detected. There was no evidence for any energy storage mechanism as suspected by Jones and Hansen (Reference 11). Excess power became apparent in cell B at 13 days and in cell A after 18 days of electrolysis (see Figure 3 of Reference 14). Including this study, these two palladium cathodes yielded excess heat in seven out of eight experiments. One cathode had a perfect four out of four record for excess enthalpy production. These palladium cathodes were once again used in H_2O control experiments that yielded no significant levels of excess heat and were later sectioned into small pieces to determine the helium content within the palladium (Reference 14). Therefore, no further calorimetric experiments were possible for these cathodes.

HEAT AND HELIUM PRODUCTION

A major conclusion of the final D_2O + LiOD experiments involving these special heat- producing palladium cathodes is that helium-4 production is associated with the excess heat events. These experiments began 3 October 1990 and ended 25 December 1990. This correlation of excess power and helium production during D_2O electrolysis is discussed in several publications (References 6 and 14 through 17). Our largest excess power effect (0.52 W) in any experiment was obtained in this study at a current density of 250 mA/cm^2 (References 14 and 15). Based on these experiments helium-4 was the major product rather than helium-3 (Reference 15). Any production of helium-3 was below our detection limit. No activation of iridium or gold foils was detected in this study, hence the average neutron emission rates were less than 10^5 s^{-1} (References 14 and 18). However, the exposure of dental X-ray films placed close to the cells suggested

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the emission of radiation (Reference 14). More than 20 similar tests involving X-ray films conducted in later experiments failed to show any significant exposure of such films.

The production of helium-4 in these experiments is a very difficult concept to prove since there is always the possibility of atmospheric helium contamination (Reference 11). More studies reporting helium-4 production will likely be required before our helium results become convincing to most scientists. In retrospect, helium-4 is probably the only nuclear product that could have remained so well hidden from view over the past 7 years of experiments. Energetic particles, penetrating radiation, or radioactive isotopes would be more readily detectable products. It is interesting to note that several theories, including that of Chubb and Chubb of NRL (Reference 19), predicted helium as a major product prior to our experiments, and predicted that this product would reside mainly in the electrolysis gas stream. The analysis of palladium samples cut from the same rod that were never subjected to electrolysis yielded helium levels too small to explain the helium production in our experiments (Reference 14). Samples of our heat-producing palladium cathodes used in the D_2O + LiOD studies were also analyzed but failed to show any significant levels of helium-3 or helium-4 (Reference 14). These results, however, are somewhat compromised by the fact that these electrodes were repolished and then used in a following H_2O + LiOH study prior to cutting samples for analysis (Reference 14). These experiments suggest that helium-4 is produced at or near the surface of the palladium electrode and resides in the electrolysis gas (Reference 14) in agreement with the theoretical predictions of Chubb and Chubb (Reference 19).

Our initial report of helium production during D_2O electrolysis was published in March 1991 (Reference 15). A major concern and criticism of these results expressed in 1991 (References 20 and 21) and continuing today (Reference 11) is the possibility of atmospheric helium-4 contamination, especially due to the known diffusion of helium through glass. It was precisely because of these concerns that we conducted control experiments performed exactly the same but using H_2O + LiOH in place of D_2O + LiOD.

These control studies gave no evidence for helium-4 production (References 14 through 16). Our first D_2O + LiOD electrolysis gas sample (10/17/90-A) also served as a control since there was no significant excess heat and no helium-4 detected (References 14 through 16). Our controls, therefore, cover time periods both before and after the excess heat experiments; this is contrary to the suggestion by Jones and Hansen (Reference 11) that we were simply getting better at keeping out helium-4.

The diffusion of atmosphere helium into our Pyrex glass flasks used to collect electrolysis gas samples is certainly a valid concern. Theoretical calculations based on the area (314 cm^2) and thickness (1.8 mm) of these flasks yields a diffusion rate of 2.6 x 10^{12} helium atoms per day from the atmosphere into the flask (References 14 and 22). Since our initial helium-4 detection limit was estimated at 10^{12} ^4He atoms/500 milliliters (mL) (References 14 through 16), helium-4 should have been detectable in every sample and in every control. As a possible explanation for this discrepancy, we proposed that the much larger amount of deuterium or hydrogen diffusing out of the glass flask may hinder the inward diffusion of atmospheric helium (References 6, 14,and 16). Although the experimental helium diffusion rates measured for our flasks were always lower for H_2 and D_2+ O_2-filled flasks than observed for N_2-filled flasks (Reference 22), the difference was not large enough to explain our failure to detect helium-4 in every flask. One H_2, and three D_2 + O_2-filled flasks yielded a mean helium diffusion rate of 1.9 ±0.3 x 10^{12} atoms/day, while three N_2-filled flasks gave a mean helium diffusion rate of 3.2 ±0.6 x 10^{12} atoms/day (Reference 22). This latter experimental rate is in good agreement with the rate of 2.6 x 10^{12} atoms/day that was calculated theoretically for our flasks (Reference 22). Based on the experimental diffusion rates of atmospheric helium into our flasks, it was obvious that our reported helium-4 detection limit of 10^{12} atoms/500 mL was too small.

Our initial helium-4 detection limit was based on measurements performed in the chemistry laboratory at the University of Texas, Austin, Texas, where 10 millitorr (mtorr) of air in 500 mL of nitrogen (N_2) yielded the observation of 4He at the detection limit of the mass spectrometer(Reference 15). Measured amounts of air were purposely introduced into various N_2 gas samples in order to determine the helium detection limit (see Table 1 of Reference 15). We reported that higher less sensitive detection limits were expected for D_2 + O_2 electrolysis gas samples versus N2 gas samples because of the different adsorption properties of these gases in the cryofilter (Reference 14). Furthermore, the ^4He content in the chemistry laboratory may have been considerably higher than the normal 5.22 parts per million (ppm) by volume assumed in our calculations (Reference 14). We did not want to overestimate our claims for ^4He production, thus we used the conservative estimate of 10^{12} ^4He atoms per 500 mL as our detection limit. This detection limit corresponds to about 0.1 parts per billion (ppb). Helium-4 analyses were later performed by a commercial laboratory (Helium Field Operations, Department of the Interior, Amarillo, Texas) that reported a detection limit of 1 to 2 ppb. It is unlikely that the initial helium analyses on our samples at the University of Texas produced a lower detection limit than a commercial laboratory that routinely performs these measurements.

Further evidence for a higher helix detection limit for our measurements is provided by four of our Pyrex flasks that were filled with N_2 from our gas discharge lines and then analyzed for helium at the University of Texas after 9 days of storage (see Table 1of Reference 15, samples 2 through 5). One flask showed the presence of ^4He at the detection limit, while no helium could be detected for the other three flasks (Reference 15).The diffusion rate of 3.2 x 10^{12} ^4He atoms/day measured for our N_2-filled flasks (Reference 22) and 9 days of storage yields a minimum helium-4 detection limit of 3 x 10^{13} ^4He atoms/500 mL or 3 ppb for our original experiments (References 22 and 23).

The most solid evidence for our higher helium-4 detection limit was obtained in experiments where the electrolysis gas samples were collected in metal flasks rather than in Pyrex glass flasks. The diffusion of atmospheric helium into the sample flasks was thereby eliminated. For five control experiments yielding no excess power, the mean background helium concentration in our system was 4.4 ±0.6 ppb or 5.1 ±0.7 x 10^{13} ^4He atoms/500 mL (References 24 and 25). Based on the measured diffusion rate of 1.9 x 10^{12} ^4He/day for D_2- and O_2-filled Pyrex flasks, it would require 27 days before the atmospheric diffusion of helium-4 into our glass flasks would equal the minimum helium detection limit of 5.1 x 10^{13} ^4He atoms/500 mL. This higher helium-4 detection limit explains why the atmospheric diffusion of helium into our glass flasks was not a major problem in our original studies (References 14 and 15). In order to clearly resolve this detection limit issue, exactly the same procedures and apparatus were used in these experiments, except for the replacement of the glass flasks with the metal flasks.

In retrospect, the higher helium detection limit resolves the issue of atmospheric helium diffusion into our flasks, explains the results for the four N_2-filled control flasks, and is consistent with the detection limits reported by a commercial laboratory. Furthermore, this higher helium-4 detection limit yields helium production rates of 10^{11} to 10^{12} ^4He/s•W, which is the correct magnitude for typical deuteron fusion reactions that yield helium as a product (References 22 through 25). The consistent merging of these various results would have been highly improbable if our initial measurements were due to errors, atmospheric contamination, or even deception. Nevertheless, the revision in our helium-4 detection limit was a major issue raised by Jones and Hansen (Reference 11) in their criticism of our work. Our explanations for

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this change (References 22 through 25) were completely ignored.

Our only gas sample in nine experiments that showed excess power, but no detectable helium, was sample 12/17/90-B (References 14 through 16). Eight days later at the end of this experiment, the D_2O level in cell B was 5.1 mL lower than in its companion cell A. An unusual voltage increase with time was observed the previous day (12/16/90) for cell B but not for cell A, suggesting that the D_2O level was already much lower than normal and was not completely covering the electrodes in cell B. We later demonstrated that the low D_2O level observed in cell B could yield a false excess heat effect. In early reports (Reference 16), we omitted both cells 12/17/90-A and 12/17/90-B from statistical treatments of our heat-helium results since the two cells were run in series. In later reports (References 14 and 22), we included cell 12/17/90-A in statistical arguments since this cell actually had an acceptable D_2O level. Naturally, Jones and Hansen (Reference 11) criticized this change. Ironically, it was criticism from Jones for omitting both cells that was voiced during a seminar presented at Brigham Young University (BYU), Provo, Utah, in 1991 that led to this change. The question remains: Do you omit both cells run in series if the experiment is flawed for one cell? If the answer is yes, then you have the earlier result; but if the answer is no, then you have the later result. Unfortunately, the sample12/17/90 A-was inadvertently left out in our preliminary report of correlated excess power and helium production (see Table 2 of Reference 15).

Jones and Hansen (Reference 11) contend that our observation of helium-4 in four out of 10 N_2-filled flasks must be included for consistent and fair statistical treatment of our data. We totally disagree because air was deliberately introduced into four of these flasks in order to estimate the helium-4 detection limit, and a fifth flask experienced an obvious air leak probably induced by air freight shipment (see Table 1 of Reference 15). The only valid controls were the four flasks filled with boil-off N2 at our laboratory and then analyzed at the University of Texas 9 days later. As discussed previously, results for these four flasks provide solid evidence that our helium-4 detection limit was considerably higher than 10^{12} atoms/500 mL (0.1 ppb) that we claimed initially.

Progress on this topic at our laboratory was very slow in 1991. Many new experiments were conducted, but almost all of them failed to produce any significant excess heat effects. Our two heat-producing palladium cathodes had been cut for helium analyses and were no longer available. Furthermore, a new lot of D_2O was being used. Late in 1991, two experiments eventually showed a small production of excess power after 6 weeks of electrolysis (Reference 22). Three gas samples were collected in Pyrex flasks as before and sent to Rockwell International Corporation, Canoga Park, California, for analyses. After measuring the rate of atmospheric helium diffusion into these flasks and extrapolating back to zero time, the measured helium-4 contents were 1.34, 1.05, and 0.97 x 10^{14} atoms/500 mL for excess power measurements of 0.100, 0.050 and 0.020 W respectively (Reference 22). The error range reported by Rockwell for the helium measurements was ±0.01 x 10^{14} atoms/500 mL or ±0.1 ppb. This represents the most accurate helium measurements in any of our experiments. Correcting for our background helium-4 level of 5.1 x 10^{13} atoms/ 500 mL yields 2, 2, and 5 x 10^{11} $^4He/s \cdot W$ (Reference 22). These rates of helium production are in the range of those expected for the fusion of deuterons to form helium-4 (Reference 22). It is interesting to note that Rockwell International, recognized as one of the best laboratories in the world for helium measurements, reports an error range (±1 x 10^{12} atoms/500 mL or ±0.1 ppb) identical to our initial (but incorrect) detection limit for helium-4. It is very unlikely that we equaled this accuracy in our initial measurements of helium-4 at the University of Texas in 1990-1991 (References 14 through 16).

CO-DEPOSITION EXPERIMENTS IN 1992

The main objective of the joint program between NAWCWPNS, NCCOSC-NRaD, and NRL that began in January of 1992 was to develop a reliable (reproducible) experimental procedure for the initiation of the anomalous effects associated with the electrochemical loading of metals with deuterium. The initial approach was to explore the co-deposition method reported by Szpak et al. (Reference 26) where palladium metal is deposited from a D_2O solution containing 0.05 M $PdCl_2$ and 0.3 M LiCl onto a copper cathode in the presence of evolving deuterium gas. This method reportedly produced excess enthalpy, tritium, and some form of radiation (Reference 26). The deposition of palladium from solution offered the possibility of generating a reproducible cathode material that is simultaneously loaded with deuterium. This approach seemed reasonable considering our poor success rate with solid palladium cathodes during 1991. Furthermore, we had previously conducted a modification of the Szpak co-deposition method that apparently produced excess power and helium-4 (see p.112 of Reference 14). Another reported advantage for the co-deposition method was that it eliminated large charging times, hence anomalous effects could be detected after about 20 minutes of electrolysis (Reference 26).

Despite the many attractive features of the co-deposition method, our experiments yielded more frustrations. Most experiments failed to produce any excess power that could be detected with our calorimetry, hence no evidence for correlations between heat and helium production could be obtained. Although this method provides for a high-purity palladium deposit that is simultaneously loaded with deuterium, this palladium deposit is often dendritic in nature. Hence, the palladium becomes detached from the electrode, floats in the solution, and adheres to the cell wall above the D_2O electrolyte level. This finely divided palladium acts as an excellent catalyst for recombination. Our co-deposition experiments sometimes resulted in loud explosions. Another problem was that the dendritic palladium deposit could contact the anode, thus some of the current could pass directly through the cell without producing any electrolysis. Expected changes in the cell voltage were often not detectable due to apparently large resistive effects across the dendritic palladium shorts.

The recombination of the D_2 and O_2 electrolysis gases could always be readily detected in our co-deposition experiments. The extent of this recombination was determined by measuring the current efficiency (γ) for the D_2O electrolysis. This was determined by measuring the rate of evolution of the $D_2 + O_2$ electrolysis gases. The resulting (can be easily applied to the calorimetric equations (Equations 1 through 3) to correct for any apparent excess enthalpy produced by recombination. This measured current efficiency would also simultaneously correct for any shorting effect or any depolarization effect due to the electrochemical oxidation of D_2 at the anode or reduction of O_2 at the cathode.

A typical co-deposition experiment where significant recombination or dendritic shorting occurs is shown in Figure 6. The apparent excess power, reaching levels up to18%, could be readily corrected for recombination or other effects by the simultaneous measurement of the rate of evolution of the $D_2 + O_2$ electrolysis gases used to determine the current efficiency (γ). The corrected values for X were then close to unity, and the overall ratio of power out/power in was X = 1.0005 ±0.022, i.e., no significant excess power was observed after applying the correction for the current efficiency. The results in Figure 6 show that recombination can be readily detected and easily corrected in our experiments. These results provide further proof that our calorimetric methods are accurate.

Several other measurements and observations provided secondary checks for any recombination of D_2 and O_2 in our experiments. The volume of D_2O added to replenish the cell was always recorded to provide another test for any significant recombination effects. Furthermore, the rate of the electrolysis gases passing through the oil bubbler could always be

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directly observed. Recombination of D_2 and O_2 within the electrolysis cell would slow or even stop the evolution of gases through the bubbler. Occasionally, recombination would even create a partial vacuum within our system, and oil would be drawn up into the upper section of the bubbler tube. Except for these co-deposition experiments involving dendritic palladium deposits, there was never any evidence for recombination in our experiments.

Many experiments have proved that the recombination of D_2 and O_2 electrolysis gases does not occur to any significant level for typical cold fusion studies using solid, fully submerged palladium cathodes (References 7 and 14). Some scientists, however, ignore this evidence and continue to claim that the excess heat effect can be explained by Faradaic efficiencies less than 100% (Reference 12). The recombination effects for nickel (Ni) and Pd cathodes reported by Jones et al. (Reference 12) used current densities of only 1 to 2 mA/cm^2. Such studies are irrelevant since excess heat effects require a threshold current density of 100 mA/cm^2. Lowering the current density in water electrolysis experiments will always decrease the current efficiency due to the slower gas evolution that allows the product at one electrode to more readily invade the vicinity and react at the opposing electrode. Furthermore, the current fraction consumed by the electrode reaction of impurities becomes larger at smaller current densities. Contrary to the comments by Jones and Hansen (Reference 11), we always measured the current efficiency at the time of collection of an electrolysis gas sample for helium analysis. This was done volumetrically by measuring the rate of the displacement of water by the electrolysis gases (Reference 14).

Between January and June of 1992, 34 composition experiments were conducted a tour laboratory. Apparent excess power was often observed as shown in Figure 6, but measurements of the current efficiency generally showed that the excess power was due to recombination or related effects. Only two of the 34 experiments gave excess power that could not be explained by a lower current efficiency. Figure 7 illustrates one of these experiments showing excess power as high as 12% even after correcting for the current efficiency. The highest excess power in a co-deposition experiment after correcting for the current efficiency was 150 mW.

In retrospect, the volume of the deposited palladium may have been too small for the excess power to be readily measured by our calorimeter. The deposition of all the $PdCl_2$ would yield only 0.002 cm^3 of palladium, hence a typical excess power density of 1 W/cm^3 of palladium would produce only 2 mW of excess power. The co-deposition experiments would have to produce 25 W/cm^3 to yield an excess power of 50 mW that could be measured by our calorimetry. It would be interesting to repeat a co-deposition experiment using a calorimeter that can measure excess power to within ±1 mW. It is possible that these co-deposition experiments produced excess power in the typical range of 1 to 5 W/cm^3 of palladium (2 to 10 mW) that was not detectable with our calorimetry. Szpak et al. (Reference 26) reported an excess enthalpy production between 10 and 40% from crude energy balance determinations.

Our experimental methods in the co-deposition experiments were similar to those reported by Szpak et al. (Reference 26) except for modifications made to accommodate our calorimetry. These changes were discussed with Stan Szpak. Our cathode was a copper rod (d = 0.63 cm, l= 1.3 cm) similar in size to our palladium cathodes instead of copper foil (A = 4.0 cm^2), and we applied constant current rather than constant potential. Typically, we applied a current of 6 mA for the first day and then increased the current to 500 mA or more for the calorimetric measurements. Despite using the same solutions and procedures, the cell voltage displayed versus time on a strip chart recorder often showed variations from one experiment to another. Variations were also observed in the palladium deposits. Some electrodes showed regions of bright, dense palladium deposits rather than the dark dendritic deposits. One experiment even gave a bright palladium deposit on the wall of the glass cell due to some electrodeless deposition process probably involving the deuterium gas. Due to the lack of reproducibility in obtaining excess heat and other anomalous effects, our co-deposition results were never published.

RADIATION MEASUREMENTS

Radiation monitoring was imposed upon us due to safety concerns but was never intended to be a major focus of our program. Since 1991, we were required to have five radiation dosimeters near our experiments (cells A and B) at distances ranging from 1 to 20 feet away. No significant radiation was measured by these dosimeters. These safety regulations were imposed because of the exposure of dental X-ray films placed near our cells in December 1990 (Reference 14). During this same time period, a GM detector with a thin window (Ludlum model 44-7) positioned near the tops of the cells gave several periods of unexplained high count rates(Reference 14, see also Figure 3 of Reference 22).

This same GM detector later produced only normal count rates for almost a year in various following experiments that failed to produce any significant excess heat effects (see Figure 4 of Reference 22). However, anomalous GM counts were again produced when experiments finally produced measurable excess power in December of 1991 (see Table IV of Reference 22). The count rates returned to normal when these cells were turned off in January of 1992.

A novel feature of the co-deposition experiments was the appearance of anomalous radiation counts shortly after applying current to the electrolysis cells. An example of high radiation counts measured during co-deposition experiments is shown in Figure 8. The same GM detector was used as in previous experiments. Examples of normal counts with this detector are shown in Figure 9. These co-deposition experiments showed high radiation count rates within a few hours of beginning the electrolysis, while the solid palladium rods always required 1 to 2 weeks before anomalous radiation was detected. No anomalous radiation effects were ever observed with this detector when the electrolysis cells were not operating. Plateau determinations for this GM detector with cesium-137(Cs-137) and iron-55 (Fe-55) sources showed normal behavior (Reference 22). The anomalous radiation was not affected by switching the scaler rate meter (Ludlum model 2200) to battery power. Moving the GM-detector away from the cell resulted in lower radiation count rates. These results suggest that the radiation was produced by the electrolysis cell rather than by some unknown artifact or error. This anomalous radiation, however, was weak and sporadic in nature. Anomalous radioactive emissions in Pd/D_2O electrolysis experiments, as measured with GM detectors, were also reported by Uchida et al. (Reference 27). The anomalous emission of low-intensity X-rays during the cathodic polarization of the Pd/D system was recently reported by Szpak et al. (Reference 28) using special cell designs that allowed the positioning of X-ray and (-ray detectors close to the cathode.

There were also several problems with the anomalous radiation measurements in co-deposition experiments. The major problem is that this effect was never reproducible. On several occasions, Steve King or Gary Phillips, both experts in radiation studies, brought X-ray and germanium detectors from NRL to China Lake to investigate this anomalous radiation. We could never reproduce this effect during these visits. An example of five short experiments during one of their visits is shown in Figure 10. Our GM detector actually showed count rates slightly below norrna1 during these co-deposition studies due to shielding effects of the additional detectors. There was no anomalous radiation.

Another major problem with the anomalous radiation measurements is that most other GM detectors seemed to be blind to this effect. We could seldom obtain substantial high count rates on two GM detectors at the same time. Nevertheless, the construction of GM detectors is an art, and

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no two detectors behave exactly the same. Every GM detector that we tested had its own unique voltage plateau and sensitivity. We later observed similar anomalous radiation effects with several other types of GM detectors and some correlation of high-count rates between two detectors. An unexpected result was the observation of high-count rates in a co-deposition control experiment in light water (H_2O).

Problems with the reproducibility of anomalous radiation in the co-deposition experiments are likely due to large changes in the negative logarithm of the hydrogen ion activity (pH) during palladium deposition

$$PdCl_2 + D_2O \rightarrow Pd + 1/2\ O_2\uparrow + 2\ DCl \qquad (6)$$

The initial 0.025 M $PdCl_2$ is converted into 0.050 M DCl. The evolution of chlorine gas was observed from the acidic solution. The dissolved chlorine (Cl_2) can passivate the copper cathode and hinder the palladium deposition. The lingering presence of Cl_2 and O_2 gases in the tubing leading to the oil bubbler in our experiments could have affected following experiments. The turnaround time between experiments was always very short when NRL radiation equipment was in place (see Figure 8). A review of our co-deposition experiments shows that the lingering presence of Cl_2 and O_2 in our tubing likely affected the anomalous radiation in co-deposition experiments. When there were less than 2 days between experiments and no N_2-flush of the rubber tubing, there was no anomalous radiation in 11 experiments. When there were 3 days or longer between experiments, anomalous radiation was observed in three out of five experiments. Experiments that followed N_2-flush of our tubing or no prior co-deposition experiments produced anomalous radiation in five out of eight experiments. This correlation of the anomalous radiation with the experimental conditions suggests that the radiation was real and explains our failure to observe anomalous radiation when visits from NRL were made. The lingering presence of chlorine likely passivated the copper and prevented solid bonding of the palladium to the copper. Poor bonding of the deposited palladium to the substrate could act as a crack and prevent the high deuterium loading required for anomalous effects.

The deposition of palladium directly from D_2O solutions remains an attractive approach for these experiments. This method offers the advantages of rapid deuterium loading of the palladium with no hydrogen contamination. The proper control of pH and other plating conditions may yield the desired reproducibility of anomalous effects. More sensitive calorimeters should be able to detect the small levels of excess power expected from the amount of palladium present. A major improvement would be the use of deuterated buffers such as deuterated ammonium chloride plus deuterated ammonia (ND_4Cl + ND_3) to control the pD (pH) of the solution. Bright palladium deposits rather than dark dendritic deposits would likely yield better results. In a single experiment using the ND_4Cl + ND_3 buffer solution containing deuterated tetraamine palladous chloride plus lithium chloride($Pd(ND_3)_4Cl_2$ + LiCl) and a gold (Au)-plated copper cathode, we obtained the anomalous radiation effect as shown in Figure 11.

TRITIUM MEASUREMENTS

The initial and final tritium concentrations have been measured in nearly every China Lake experiment, but no substantial evidence for tritium production has been obtained. Our first experiments that produced excess heat showed no significant increase in tritium concentrations (Reference 4). An unusual increase in tritium was observed in one experiment following the addition of thiourea. The tritium level in that cell increased from 47 to 84% above that of the stock D_2O (375 disintegrations per minute per mL (dpm)/mL) within 3 days of the thiourea addition (Reference 22). No thiourea was added to the companion cell, and no unusual increase in the tritium level was observed.

The expected increase in tritium during D_2O electrolysis is given by

$$\frac{a(t)}{a(o)} = S - (S-1)e^{-tI/2FSnV} \qquad [7]$$

where a(o) and a(t) are the activity of tritium initially and at the time t, respectively, and S is the isotopic separation factor (Reference 29). This equation assumes a constant current, I, a constant volume, V, and that the number of deuterium atoms far exceeds the number of tritium atoms. At the end of our experiments, due to t being very large (t >20 days), a(t)/a(o) ≈ S. For four experiments using palladium rod cathodes in D_2O, we obtained a(t)/a(o) values of 1.2, 1.8, 2.0, and 1.4 suggesting S = 1.6±0.4. Equation 7 assumes that S remains constant throughout the course of the experiment. This assumption may not be valid since S depends upon the kinetics of the electrode reactions as well as on the current density (Reference 29). This may explain our variation in S values. The exponential term in Equation 7 can be neglected for electrolysis times larger than about 20 days for our typical experimental conditions (I = 0.5A, V = 18 mL, n =0.055 mol/mL for D_2O).

Tritium results for nine co-deposition experiments are given in Table 1. These tritium analysis were performed by P. A. Mosier-Boss at the NRaD laboratory. Five of these experiments produced anomalous excess radiation based on the GM detector results. Theoretical values for a(t)/a(o) calculated from Equation 7 using S = 2 are given in parenthesis for comparisons with the experimental values. Due to the short time periods for co-deposition experiments, the exponential term in Equation 7 cannot be neglected. Only two of these experiments produced a(t)/a(o) values greater than the theoretical calculations (experiments 3/1-3/6/92 and 3/15-3/18/92). Since we have selected a rather high value of S = 2, these two experiments suggest an anomalous production of tritium. This conclusion is especially true for the 3/1-3/6/92 experiment. Nevertheless, the excess tritium production is not large enough to be convincing to most scientists who are skeptical towards this field. Szpak et al. (References 28and 29) report that tritium is produced sporadically in co-deposition experiments at an estimated rate of about 10^3 to 10^4 atoms per second. This rate of tritium production is about 10^7 to 10^8 below the rate required to produce 100 mW of excess power, assuming deuterium fusion to yield tritium (1 W = 1.55 x 10^{12} fusions/s). Our results support the large body of evidence that tritium production in D_2O electrolysis experiments is far too small to explain any excess heat production (References 7 and 17).

NRL MATERIALS: PD-AG ALLOY STUDIES

The next approach for this program was to produce palladium and palladium alloy materials within the Navy since the metallurgy of the palladium cathode seemed to be the critical variable. M. Ashraf Imam of

TABLE 1. Tritium Results for Co-Deposition Experiments (Cu/D_2O + LiCl + $PdCl_2$/Pt).

Experiment	Excess radiation[a]	a(t)/ao[b]	Δ ^{3}H, dpm/mL	Δ ^{3}H/day,[c] dpm/mL
4/28-5/4/92	73 σ	1.280 (1.470)	71.29	11.88
3/23-3/31/92	69 σ	1.262 (1.588)	87.74	10.97
2/1-2/13/92	65 σ	1.520 (1.752)	173.68	14.47
3/1-3/6/92	39 σ	1.596 (1.398)	199.79	39.96[d]
4/1-4/13/92	21 σ	1.282 (1.752)	94.40	7.87
3/9-3/13/92	None	1.205 (1.316)	68.68	17.17
3/15-3/18/92	None	1.205 (1.163)	68.69	22.90
4/24-4/28/92	None	1.200 (1.316)	50.88	12.72
5/14-5/18/92	None	1.183 (1.316)	46.61	11.65

[a] Based on 12-hour counting period using Geiger-Mueller alpha-beta-gamma detector (Ludlum Model 44-7).
[b] Theoretical value in parenthesis is calculated from $a(t)/ao = S-(S-1)e^{-tI/2FSnV}$ with S = 2.
[c] Omitting highest value (39.96), mean is 11.30 ±2.72 for experiments with excess radiation and 16.11 ±5.12 for experiments with no excess radiation.
[d] Value is 10 σ above 11.30 ±2.72 mean of other experiments with excess radiation.

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NRL prepared and characterized these materials. This approach would remove the major obstacle of depending upon outside suppliers of palladium for good cathode materials that would yield excess heat. Furthermore, we could study factors such as grain size, impurity levels, and alloy compositions that may affect the anomalous excess heat effect. The palladium materials that produced excess heat at China Lake generally had small grain sizes.

Our first experiments with NRL materials involved the study of Pd-silver (Ag) electrodes. These electrodes were stored in our vacuum oven at 130°C for several days prior to use. For these experiments, we did not use silicon rubber or epoxy on any cell component, and we did not connect our cells to the oil bubbler. A platinum lead was attached to these electrodes by NRL using a groove arrangement. No excess power was observed in our calorimetric studies of the Pd-Ag alloys provided by NRL. The calorimetric results for two experiments are shown in Figure 12. The mean X-values are actually slightly below unity for these two studies. This is perhaps due to our neglect of the P_{gas} and P_{calor} terms (Equations 2 and 3) in our earlier calorimetric studies. At the end of this experiment, a large, deep crack was observed for the cell A cathode. Grooves were made near the top of these Pd-Ag cathodes for the platinum lead attachments that may have also acted as cracks and hindered loading.

Despite the lack of excess heat, an interesting feature of the Pd-Ag studies was the measurement of anomalous radiation with two different detectors. This effect is shown in Figure 13. The same GM detector as used in previous studies was placed near cell A, while a NaI detector was placed near cell B. The NaI detector showed anomalous high count rates after 7 days of electrolysis, while the GM detector showed anomalous radiation after 15 days of electrolysis. The count rates returned to normal for both detectors when these cells were turned off. This is one of our few examples where anomalous radiation was observed in the same set of experiments with two different detectors. Although the detectors were focused on two different cells, they were less than a foot apart and many of the peaks for anomalous radiation seem to occur simultaneously.

It is interesting to compare the long time periods required before the onset of anomalous radiation when solid cathodes are used (Figure 13) with the rapid production of excess radiation in co-deposition experiments (Figures 8 and 11). The palladium is simultaneously loaded with deuterium as it is deposited from solution in the co-deposition studies. This logical difference in behavior between these two types of experiments would not likely be due to erratic radiation detectors. Several other experiments involving solid palladium cathodes produced anomalous radiation, but this effect always required prolonged periods of electrolysis (References 14 and 22). Evidence for radiation that occurred within 12 hours of co-deposition has also been reported by Szpak et al. (Reference 26). In their recent search for emanating radiation using X-ray and γ-ray detectors, Szpak et al. (Reference 28) observed an increase in the count rate shortly after the initiation of the Pd/D co-deposition process. Several days of charging were required to observe the same effect on a solid-palladium foil surface (Reference 28). Unfortunately, our sensitive GM detector was accidentally destroyed shortly following the Pd-Ag experiments. Similar measurements of anomalous radiation were recorded in later experiments using other types of GM detectors. As before, these new detectors never showed anomalous radiation except when the electrolysis experiments were running.

A third experiment using the NRL Pd-Ag alloy also failed to show any significant excess heat effect. This experiment ran for 66 days (27 November 1992 to 4 February 1993) in cell B. The mean ratio of power out to power in was $\bar{X}_B = 1.004 \pm 0.013$. There were no X-values outside the $\pm 3\sigma$ effect for this cell. The companion study run in series with the NRL Pd-Ag was a Johnson-Matthey palladium cathode (cell A). This experiment yielded a mean calorimetric value of $\bar{X}_A = 1.006 \pm 0.015$. Once again there was no measurable excess heat in this experiment and no X-value outside the $\pm 3\sigma$ effect for this cell. These results support our stated calorimetric error range of approximately ±1%.

Two NaI radiation detectors were positioned near cells A and B in the above experiment. For the detector near cell A (Pd cathode), the window was set to count only radiation with energies above 660 kiloelectron volts (KeV), while the detector near cell B (Pd-Ag cathode) was set to count all energies. Anomalous radiation was observed with both detectors. The results of this study suggest a broadband radiation effect consisting of energies above and below 660 KeV. The larger fraction of the excess radiation detected apparently has energies below 660 KeV. Although the anomalous radiation was a 12σ effect for the detector near cell A and a 19 F effect for the detector near cell B, the net increase in radiation was only a 2 to 3% effect (160,336/6 hours versus a normal count of 155,648/6 hours for cell A and 483,427/6 hours versus a normal count of 470,219/6 hours for cell B).

NRL MATERIALS: PD CATHODE STUDIES

Following the studies of Pd-Ag alloys supplied by NRL that showed no evidence for excess heat, we focused our attention on pure palladium cathodes received from NRL. Six studies of NRL palladium cathodes were completed, but excess heat was observed in only one experiment. This one experiment showing excess power involved a second study of the same cathode. After an experiment that showed no excess enthalpy, the palladium cathode was allowed to de-load for 2 weeks, then the experiment was restarted. On this second study with the same cathode, excess power was observed. This second experiment with the same NRL Pd cathode is shown in Figure 14. The excess power is not large, averaging only about 50 mW, but this effect is persistent throughout most of the experiment. This represents another example where excess power was not observed in the first study but was present in the second study using the same cathode.

Our failure to observe excess heat with NRL-prepared Pd-Ag alloys or Pd cathodes, with the one exception discussed above, was a major disappointment. The reproducible measurement of excess enthalpy with in-house materials would have allowed us to begin to unravel the metallurgical mysteries that contribute to these anomalous effects. Our calorimetric failures, however, were consistent with loading studies performed at both NRL and SRI using these materials. Both laboratories reported poor deuterium loading for the NRL palladium rods.

OTHER CATHODE MATERIALS: NO EXCESS HEAT

Various other palladium materials were tested in attempts to obtain excess heat and helium-4 measurements. Two new calorimetric cells (C and D) were constructed in June 1992 and placed in operation. These were similar to cells A and B except that foam insulated caps were used to minimize the heat loss through the top of the cells.

Ten consecutive calorimetric studies using cells C and D failed to produce any significant excess enthalpy. Four of these studies, however, were H_2O-LiOH control calibration experiments. Two experiments using palladium sheet cathodes supplied by Tanaka Kikinzoku Kogyo K. K., Kanagawa, Japan, yielded no excess heat. A. Takahashi et al. (Reference 30) previously reported a very large excess power (100 to 300 W at peaks) for this material. Two repeated experiments using a newly purchased palladium rod from Johnson-Matthey with a cathode size of 4 mm x 1.6 cm did not produce any measurable excess power. Finally, two repeated experiments using Pd-10% Ag (4 mm x 1.6 cm) loaned to us from IMRA Material R and D Co., Ltd. (IMRA), Kariya, Aichi, Japan, failed to produce any excess power. These later experiments, however, are significant in that electrolysis gas samples were collected in metal flasks that helped to determine the background helium levels in our system. This will be dis-

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cussed in the section, Heat and Helium Studies Using Metal Flasks.

Numerous experiments conducted in calorimetric cells A and B involving various cathode materials also failed to produce any significant excess enthalpy. Two experiments used palladium plated cathodes (Pd/Au/Cu) where gold is first plated onto a copper rod then palladium is plated onto the gold. No excess heat was observed. The Johnson-Matthey palladium rod run in cell A as a companion cell to the third NRL Pd-Ag cathode failed to produce any excess heat.

A novel experiment using cells A and B involved acidified D_2O prepared by adding 10.6 mL of concentrated sulfuric acid (H_2S0_4) to 60 mL of D_2O. Cold-rolled palladium sheet cathodes and procedures were supplied by Professor John Dash of Portland State University who claimed a reproducible excess heat effect with his method. No calorimetric evidence for excess heat could be established for either cell in our experiments. The power ratio for cell B is shown in Figure 2. The input and output powers for cell B are illustrated in Figure 15. The calorimetrically-measured output power tracks very closely to the electrochemical input power. This verifies our calorimetric accuracy over a range of input powers. The measured excess power for this cell is shown in Figure 16. All results are within $\pm 2\sigma$ (±40 mW) of our estimated calorimetric error (±20 mW). These experiments provide a test of our calorimetry in a completely different solution (D_2O + H_2SO_4). A notable feature of these experiments was the smaller voltage drop across the cells due to the high conductivity of this solution. The noise or oscillations in the cell voltages was also extremely small in these experiments. Nevertheless, no excess heat was measured. Anomalous radiation, however, was observed in these experiments with the use of a new type of GM detector purchased from TGM Detectors, Inc. (TGM), Waltham, Massachusetts. These detectors consisted of high-sensitivity platinum and tungsten-lined GM tubes.

OTHER CATHODE MATERIALS PRODUCING EXCESS HEAT

Despite the many failures, several new experiments produced measurable amounts of excess enthalpy. The most notable examples involved cathode materials loaned to us by Martin Fleischmann of IMRA Europe, Valbonne, France. Two experiments involving palladium rods of different diameters (1 and 2 mm) were set up in cells C and D. Measurable amounts of excess heat were observed for both cells, and the larger diameter rod produced the larger amount of excess power. The excess power results for the 2-mm Pd rod are shown in Figure 17. This experiment began on 23 April 1993 with the current held at 50 mA until 1 May 1993. No significant excess power was observed until 7 May 1993. The average excess power was about 50 mW until 20 June 1993. Excess power peaks as large as 250 mW were observed later in this experiment. The cell voltage became very high (21 V) near the end of this experiment, producing high-cell temperatures (88°C) and less accurate calorimetry. The decline in excess power early in July may simply be due to operating outside the calibration range for this calorimeter. A smaller excess power effect was observed for the 1-mm-diameter palladium used in cell C. A following experiment in H_2O-LiOH in cell C using the same 1-mm-palladium cathode did not produce any significant excess power. Electrolysis gas samples were collected in metal flasks for helium analysis for each of these experiments, and results will be discussed in a later section.

Another sample provided to us by Martin Fleischmann was a Pd-Ce alloy material. This experiment began on 15 February 1994, and the onset of excess power production was observed on 4 March 1994. The excess power versus time for the Pd-Ce cathode is displayed in Figure 18. The excess power levels for this cell reached values as high as 350 mW. The excess power production for Pd-Ce in cell C remained for over 100 days of electrolysis. Gas samples were again collected in metal flasks for helium analysis. A repeated run with the Pd-Ce cathode in cell C again showed excess power levels up to 150 mW.

Several other experiments produced small excess power effects. A palladium-plated copper cathode (Pd/Cu) used in a D_2O-LiOD solution containing 500 ppm boron oxide (B_2O_3) produced a steady 2 to 4% excess power in cell D. A companion cell in series using a similar Pd/Cu cathode in D_2O-LiOD containing 500 ppm sodium metasilicate (Na_2SiO_3 . 9 H_2O) failed to produce any measurable excess power. An interesting observation at the end of these experiments was the dark material on the Pd/Cu used with Na_2SiO_3 . 9 H_2O and the bright appearance of Pd/Cu used with B_2O_3. The Pd/Cu cathode in D_2O-LiOD plus 500 ppm B_20_3 is our only experiment involving a palladium-plated cathode that produced excess power. Although this 2 to 4% excess power is not clearly outside the bounds of calorimetric error, it suggests a possible role for boron in the anomalous excess heat effect. Glass contains B_2O_3 and boron is generally found as an impurity in palladium.

Experiments that began on 26 February 1993 using the Tanaka palladium plate from Japan in cell A and Johnson-Matthey 1-mm-diameter palladium wire in cell B produced small levels of excess power. The excess power was only 50-100 mW for these two cells or 3 to 4% above the input power. Nevertheless, larger effects would not be expected based on the small volume of these cathodes (0.05 cm^3 for the palladium plate and 0.02 cm^3 for the palladium wire). The excess power densities were in the normal range of 1 to 5 W/cm^3 for these two cathodes. The small excess power was fairly steady during these experiments, but effects this small are not clearly outside the limit of our calorimetric error. This Johnson-Matthey wire became a focus of later experiments since we had a large supply of this palladium. Experiments by Wilford Hansen at Utah State University, Logan, Utah, reported excess power using this palladium wire as did experiments at China Lake using our more sensitive calorimeters developed by Kendall Johnson.

USE OF ADDITIVES

The addition of substances that poison the cathode and increase the overvoltage has been advocated since the first report of cold fusion studies on 23 March 1989. McKubre et al. (Reference 1) have tested aluminum (A1), boron (B), Cu, Ni, silicon (Si), beryllium (Be), and classical hydrogen recombination poisons as additives in their experiments. The presence of Al or Si is believed to be important in promoting deuterium loading and excess heat. For experiments performed in quartz or glass vessels, silicon will be present in increasing amounts as this element dissolves in the LiOD solution.

We have investigated various additives in many different experiments, but no significant excess heat events can be clearly traced to these additives. The additives investigated at China Lake include sulfur, zinc oxide (ZnO), thiourea, silicates, Al, B, and magnesium perchlorate ($Mg(ClO_4)_2$). One of our early publications (Reference 4) reports on additions of sulfur and ZnO to the solutions in two different cells, but no measurable changes could be discerned in the excess power production. As mentioned previously, a small excess heat effect (2 to 4%) was measured using a Pd/Cu cathode in D_2O-LiOD containing 500 ppm B_2O_3 The addition of silicates often produced severe passivation of the electrodes, resulting in high-cell voltages, but no significant excess power was detected. The addition of $Mg(ClO_4)_2$ produced a sharp decrease in cell voltages due to an apparent depassivating effect on the electrodes. In several experiments, the addition of $Mg(ClO_4)_2$ seemed to produce a small increase in excess power. Perhaps our cathodes were usually covered by silicates from the glass cells, hence other additives produced only small effects. As reported previously (Reference 22), the addition of thiourea to one of our cells may have increased the tritium production.

HEAT AND HELIUM STUDIES USING METAL FLASKS

Metal flasks were used in place of glass flasks to collect electrolysis gas samples for helium analysis in a new set of heat and helium experiments. The use of metal

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TABLE 2. Helium Measurements in Control Experiments Using Metal Flasks. No excess power was measured.

Electrode	Flask/cell, date	^{4}He[a], ppb	^{4}He, atoms/ 500 mL
Pd Rod[b] (4 mm x 1.6 cm)	1/C (2/24/93)	4.8 ±1.1	5.5 x 10^{13}
Pd-Ag Rod[b] (4 mm x 1.6 cm)	2/D (2/24/93	4.6 ±1.1	5.2 x 10^{13}
Pd Rod[b] (4 mm x 1.6 cm)	3/C (2/28/93)	4.9 ±1.1	5.6 x 10^{13}
Pd-Ag Rod[b] (4 mm x 1.6 cm)	4/D (2/28/93)	3.4 ±1.1	3.9 x 10^{13}
Pd Rod[c] (1 mm x 1.5 cm)	3/C (7/7/93)	4.5 ±1.5	5.1 x 10^{13}
Pd Rod[d] (4.1 mm x 1.9 cm)	3/D (3/30/94)	4.6 ±1.4	5.2 x 10^{13}
(Mean)		4.5 ±0.5	(5.1 ±0.6 x 10^{13})

[a] Helium analysis by U.S. Bureau of Mines, Amarillo, Texas.
[b] D_2O + LiOD (I = 500 mA).
[c] H_2O + LiOH (I = 500 mA).
[d] D_2O + LiOD (I = 600 mA).

flasks prevents the diffusion of atmospheric helium into the flasks after they are sealed. The valves used in these flasks were modified to effect a metal seal with a nickel gasket. Experimental details for these metal flasks are reported elsewhere (Reference 30). All other components of the cells, gas lines, and oil bubblers remained the same in order to relate these new measurements to previous measurements using glass flasks. The rubber tubing used for the gas lines was periodically replaced to maintain the same conditions as in previous studies.

Six control experiments using four metal flasks where no excess power was measured yielded 4.5 ±0.5 ppb ^{4}He or 5.1 ±0.6 x 10^{13} ^{4}He atoms/500 mL as shown in Table 2. These values show that our experimental procedures are very consistent. Five of these control experiments were reported elsewhere (References 24, 25, and 30). The helium analysis was performed by the U.S. Bureau of Mines laboratory in Amarillo, Texas, and yielded a typical error range of ±1.1 ppb. These samples were all from experiments that never produced any evidence for excess heat. No measurable differences occurred in our background levels of ^{4}He over a period of more than a year. Four metal flasks were employed, but the particular metal flask that was used produced no significant difference in the background helium result (Reference 25).

In experiments producing excess power, seven helium measurements using these same four metal flasks were completed. Results for five of these studies have been reported previously (References 24, 25, and 30). Results for all seven experiments are given in Table 3. After correcting for the background level of helium measured in our control studies, each experiment in Table 3 yields a helium-4 production rate close to 1 x 10^{11} ^{4}He/s W. These results using metal flasks are consistent with our previous results using glass flasks (References 14 and 22).

We completed 18 measurements of excess helium for experiments producing excess heat. These helium measurements were performed at three different laboratories: the University of Texas (References 14 and 15), Rockwell International (Reference 22), and the U.S. Bureau of Mines (References 24, 25, and 31). The helium measurements from all three laboratories yield helium-4 production rates of 10^{11} to 10^{12} ^{4}He/s•W (Reference 25).We have also completed 12 measurements of helium for experiments that did not produce any measurable excess heat, including six experiments in H_2O-LiOH solutions. These experiments all yielded either undetectable amounts of helium (References 14 through 16) or lower levels of helium-4 (References 24, 25, and 31) that established the background helium level present in our system, as well as the minimum helium-4 detection limit for our first experiments using glass flasks. This background level of helium-4 arises mainly from the diffusion of atmospheric helium through the thick-walled rubber tubing used in our gas lines (Reference 25).

TABLE 3. Helium Measurements Using Metal Flasks. Experiments producing excess power.

Electrode	Flask/cell, date	^{4}He[a], ppb	Px, W	^{4}He/s•W[b]
Pd Sheet[c] (1.0 mm x 3.2 cm x 1.6 cm)	3/A (5/21/93)	9.0 ±1.1	0.055	1.6 x 10^{11}
Pd Rod[c] (1 mm x 2.0 cm)	4/B (5/21/93)	9.7 ±1.1	0.040	2.5 x 10^{11}
Pd Rod[c] (1 mm x 1.5 cm)	1/C (5/30/93)	7.4 ±1.1	0.040	1.4 x 10^{11}
Pd Rod[c] (2 mm x 1.2 cm)	2/D (5/30/93)	6.7 ±1.1	0.060	7.0 x 10^{10}
Pd Rod[d] (4 mm x 2.3 cm)	1/A (7/7/93)	5.4 ±1.5	0.030	7.5 x 10^{10}
Pd Rod[d] (6.35 mm x 2.1 cm)	2/A (9/13/94)	7.9 ±1.7	0.070	1.2 x 10^{11}
Pd-B Rod[d] (6 mm x 2.0 cm)	3/B (9/13/94)	9.4 ±1.8	0.120	1.0 x 10^{11}

[a] Helium analysis by U.S. Bureau of Mines, Amarillo, Texas.
[b] Corrected for background helium level of 5.1 x 10^{13} ^{4}He/500 mL.
[c] D_2O + LiOD (I = 400 mA).
[d] D_2O + LiOD (I = 500 mA).

The helium measurements presented in Table 3 are all taken from experiments that produced steady excess heat effects. For example, the 2/D (5/30/93) sample is from the experiments involving the 2-mm palladium rod obtained from Martin Fleischmann that is shown in Figure 17. Larger excess power effects were present later in this experiment, but no metal flasks were available due to the slow turnaround time for the shipment and analysis. The 1/C (5/30/93) sample involves the 1-mm palladium rod, while the 3/A(5/12/93) result was obtained with the Tanaka palladium sheet cathode. The largest excess power in Table 3 was obtained using a Pd-B cathode (0.75 weight %B) prepared by NRL. The excess power measurements for this Pd-B experiment are presented in Figure 19.

Higher excess power effects would have been better for the helium measurements using metal flasks (Table 3). Although the excess power effects are small, these measurements involved experiments where a consistent excess power was observed. In contrast, experiments used for control studies never showed any significant evidence for excess power (References 24, 25, and 31). A theoretical relationship between excess power and helium production is given in Table 4. Excess power levels of 200 mW or higher would be desirable to minimize the errors in the calorimetry and helium measurements. It should be noted that for any given excess power, the helium concentration in the electrolysis gas stream will be inversely proportional to the current (Reference 25).

A puzzling helium result was obtained for the Pd-Ce cathode that produced the large excess power effect shown in Figure 18. Despite excess power measurements as large as 300 mW, no excess helium could be detected. These results are presented in Table 5. The companion cell employing a NRL Pd rod gave no excess power and almost the same amount of helium-4 (4.6 ±1.4 ppb) as found for the Pd-Ce experiment. This represents our only experiment where valid excess power was measured but no

TABLE 4. Theoretical Relationship Between Excess Power and Helium Production. Magnitude of experimental errors.

Px, W	^{4}He[a], ppb	^{4}He, atoms/ 500 mL	^{4}He error,[b] %	Calorimetric error,[c] %
0.050	5.6	6.38 x 10^{13}	18	40
0.100	11.2	1.28 x 10^{14}	8.9	20
0.200	22.4	2.55 x 10^{14}	4.5	10
0.500	56.0	6.38 x 10^{14}	1.8	4
1.000	112.0	1.28 x 10^{15}	0.9	2

[a] For I = 500 mA assuming $^2D + {}^2D \rightarrow {}^4He + 23.8$ MeV is the fusion reaction.
[b] ±1 ppb.
[c] ±0.020 W.
NOTE: N. Lewis (CalTech) and D. Albagli (MIT) reported gas-phase helium detection limits of 1000 ppb (1 ppm) in their 1989-1990 publications.

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excess helium was detected. An experiment at SRI using the same source for Pd-Ce also gave excess heat but no excess helium according to Ben Bush. An earlier experiment using a palladium cathode (sample 12/17/90-B) yielded 11% excess power (290 mW) but no detectable helium (Reference 14 and 22). This 1990 experiment, however, was flawed due to a very low D_2O level in the cell (Reference 14 and 22). Later experiments showed that this low D_2O level could produce a calorimetric error that would account for most of the reported excess power. There were no other palladium cathodes that did not show a correlation between excess power and helium production.

We can estimate from Figure 18 that the Pd-Ce cathode produced 1.1 megajoules (MJ) of excess heat over a 110-day period. No chemical process can account for more than about 20 kJ in our system (Reference 4). Assuming typical deuteron fusion reactions that produce helium-4, the 1.1 MJ of excess enthalpy would produce a minimum of 3.7×10^{17} atoms of helium-4 (Reference 22). Since no measurable helium was observed in the gas phase (Table 5), these helium atoms may remain in the Pd-Ce electrode. This would correspond to 1.4×10^{14} atoms/milligram (mg) and would be readily measurable by Rockwell International (10^8 atoms/mg detection limit, see Reference 14). The measurement of ^{4}He atoms within the Pd-Ce cathode has not been done. One problem is our lack of an unused Pd-Ce sample that could be tested as a control.

TABLE 5. Excess Power and Helium Measurements in Experiments Using a Palladium-Cerium Cathode.

Electrode	Flask/cell, date	^{4}He[a], ppb	Px, W	^{4}He/s•W[b]
Pd-Ce Rod[c] (4.1 mm x 1.9 cm)	1/C (3/30/94)	4.6 ±1.4	0.17	0
Pd-Ce Rod[c] (4.1 mm x 1.9 cm)	4/C (4/19/94)	4.7 ±1.3	0.30	0
NRL Pd Rod[c] (4.1 mm x 1.9 cm)	3/D (3/30/94)	4.6 ±1.4	0	...
NRL Pd Rod[c] (4.1 mm x 1.9 cm)	2/D (4/19/94)	>1000[d]	0	...

[a] Metal collection flasks, analysis by U.S. Bureau of Mines, Amarillo, Texas.
[b] Corrected for background helium level of 4.5 ±0.5 ppb.
[c] D_2O + LiOD (I = 600 mA).
[d] Broken solder joint on metal flask.

MISCELLANEOUS HELIUM MEASUREMENTS

Four metal flasks were received from NRL to test for helium measurements. These were connected to the Pd-Ce experiment (cell C) and the NRL Pd experiment (cell D). Unusually high-helium concentrations were obtained, i.e., 41.5 ±5.6 ppb for the Pd-Ce sample and 40.6 ±4.3 ppb for the NRL Pd sample (I = 600 mA). Later experiments using the other two NRL flasks yielded 5.6 ±1.6 ppb for the Pd-Ce study (cell C) and 5.4 ±1.6 ppb for the NRL Pd study (cell D) with I = 800 mA. The large differences in helium amounts for these two sets of experiments using four different metal flasks cannot be readily explained. Perhaps the fact that the valves for the NRL flasks were not modified to give a metal-to-metal seal is a factor. Nevertheless, the helium measurements for the Pd-Ce and NRL Pd cells were always in close agreement, as found in Table 5, using our metal flasks. The second Pd-Ce helium measurements (5.6 ±1.6 ppb) involved a near boil-off condition (T = 94°C) due to a high-cell voltage produced by passivation, yet the measured helium concentration remained small.

Glass flasks were used in four helium measurements involving the 1- and 2-mm palladium rods obtained from Martin Fleischmann that produced excess heat (see Figure 17). The metal flasks normally used had been shipped out for earlier helium measurements and were unavailable. Flask #2 (6/16/93) for cell D (2-mm Pd) gave 15.2 ±2.3 ppb for I = 400 mA and 120 mW of excess power while flask #1 (6/29/93) for this same cell gave 8.9 ±1.8 ppb for I = 600 mA and 135 mW of excess power. Correcting for the background helium and the rate of helium diffusion into the glass flasks yields 1×10^{11} ^{4}He/s•W for flask #2 and 4×10^{10} ^{4}He/s•W for flask #1. These results are somewhat low, especially for flask # 1, but still are reasonably consistent with those obtained using metal flasks (Table 3). The other two glass flasks were used with cell C (1-mm Pd) under conditions of high-cell temperatures where our calorimetry is not as accurate. Flask # 5 (6/17/93) for cell C gave 14.0 ±2.2 ppb helium under boil-off conditions with severe electrode polarization (E = 23 V, I = 450 mA). Flask #20 (6/20/93) for cell C yielded 16.9 ±2.4 ppb helium at a cell temperature of about 85°C. Judging from these helium results, no substantial excess of helium-4 was produced during cell boil-off conditions. Furthermore, there did not appear to be any measurable excess power effects at these high-cell temperatures.

Glass flasks were used with a D_2O-LiCl study (cell A) and H_2O-LiCl experiment (cell B). Electrolysis gas samples taken on 13 September 1991 yielded 14 ±2 ppb helium for cell A and 17 ±2 ppb helium for cell B (I = 525 mA). No significant excess power was measured in either experiment. The background helium levels were rather high in these two experiments. These two studies differ from other experiments in that they involved a modification of the co-deposition process via anodic and cathodic treatments of the palladium with 0.3 M LiCl replacing the usual LiOD electrolyte.

NRL PALLADIUM-BORON MATERIALS

The most successful collaboration in this program was the production of Pd-B alloys at NRL and the calorimetric testing of these materials at China Lake. Seven out of eight palladium-boron experiments produced evidence for excess heat production. These calorimetric studies of Pd-B materials were all completed during the final year of this program (1994-1995). As mentioned previously, the largest excess power reported in Table 3 for helium measurements using metal flasks was obtained using a Pd-B cathode prepared by NRL. The excess power measurements for this experiment are shown in Figure 19. This cathode contained 0.75 weight % B and had a 6-mm diameter and a 2.0 cm length with rounded ends. This Pd-B experiment was turned off and then restarted 8 days later. Excess power was again observed as shown in Figure 20. The excess power levels were similar to the first experiment (Figure 19) except for higher power peaks later in the second experiment (Figure 20). This again demonstrates that excess power can be obtained in repeated experiments using the same cathode.

The next two studies of NRL Pd-B alloys showed excess power in one experiment, but no significant effect in the other experiment. These measurements are shown in Figures 21and 22. The excess power for cell C showed a gradual increase with time and reached levels exceeding 300 mW (Figure 21). The second cell run in series (cell D) showed fluctuations mainly within ±50 mW and no significant production of excess power (Figure 22). There was clearly no gradual increase of excess power as shown in Figure 21. It was noted at the beginning of this experiment that the cathode in cell D was poorly aligned. This leads to an uneven current distribution and low loading of deuterium into the cathode. After this experiment, examination of the Pd-B cathode that did not produce excess power (cell D) showed an obvious flaw. Swaging of this rod had produced a large, folded-over metal region that would act as a long crack. In contrast, the heat-producing Pd-B cathode had no obvious flaws or cracks. Both cathodes consisted of 0.75 weight % B. with a rod diameter of 2.5 mm and a length of 2.5 cm (V = 0.12 cm^3). The end of the heat-producing electrode was left straight, while the end of the other cathode was rounded using a file. No silicon rubber or epoxy was used in these two experiments, in contrast to the experiments shown in Figures 19 and 20. No helium measurements were performed for these experiments or for any later experiments, because we were directed to focus

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only on the excess-heat effect during the last year of this program.

The next series of Pd-B alloy studies explored the effect of lower B concentrations. Two studies of the 0.5 weight % B alloy are shown in Figures 23 and 24. These experiments began on 3 March 1995, thus the first data points shown are after 11 days of electrolysis. A fairly steady excess-power effect is found in both experiments with typical levels of 50 to 100 mW. Results for the 0.25 weight % B alloys are shown in Figure 25 and 26. The excess power averages about 100 mW for cell C (Figure 25) with peaks of 150 to 200 mW. In contrast, cell D (Figure 26) shows a 5-day period of excess power early in the experiment and then no other episodes of significant excess power. The power ratios for cells C and D are shown in Figures 27 and 28, respectively. Large, negative deviations in excess power were usually associated with electrode passivation problems that produced high-cell temperatures outside our normal calibration range. The addition of $Mg(ClO_4)_2$ to break down the passivation or the increase of the LiOD concentration brought the cell temperature back to the normal range. Although the largest excess power was observed with the higher B concentrations (Figure 21), there is no clear picture of how the B content in the palladium affects the excess power. Flaws, cracks, or other defects in the Pd-B alloys likely play a major role, as shown by the results in Figures 21 and 22. The 0.5 and 0.25 weight % B alloys all had dimensions of 4 mm x 2 cm (V = 0.25 cm^3). Microscopic examinations of these four Pd-B cathodes following the experiments did not reveal any significant cracks, folded-over metal regions, or other flaws for these NRL materials. The high-success rate for excess-power production for Pd-B alloys suggests that this would be a fruitful area for further research. Perhaps the presence of B initially as an impurity in the palladium or the incorporation of B from the glass into the palladium during the experiment is a factor in the reproducibility problem for excess-heat production. It is also possible that the increased hardness of the palladium due to the added B allows it to better withstand the high stresses induced by the experiments.

Deuterium loading studies by the weighing method were conducted for six of the Pd-B alloy experiments. In general, the rate of loading of deuterium into the alloy was much slower than the rate observed for pure palladium electrodes. Studies of loading at NRL using resistance measurements also showed very slow loading rates for Pd-B alloys. The presence of B at the grain boundaries likely hinders the ingress and egress of deuterium.

Table 6 presents loading studies by the weighing method for the 0.50 and 0.25 weight % B alloys. The loading of deuterium into the Pd-B alloys is slow and the loading levels are not especially high. Table 7 presents de-loading studies for these same four Pd-B alloys. The rate of deuterium exiting the electrode is very slow, hence the weighing method works quite well for these alloys. A comparison of Tables 6 and 7 indicates that the deuterium loading levels did not increase significantly after the first 10 days of electrolysis for any of these Pd-B alloy cathodes. The alloys with the lower concentration of B (0.25 weight %, cells C and D) always showed somewhat higher loading levels than the 0.50 weight % alloys (cells A and B). McKubre et al. (Reference 10) has shown a clear relationship between excess power and loading levels for pure palladium cathodes.

Loading studies for two Pd-B alloys containing 0.75 weight % B are shown in Table 8.Excess power was produced for cell C but not for cell D (see Figures 21 and 22). The deuterium loading level was always higher for the heat-producing alloy. A large difference in deuterium loading was obtained at the end of these experiments (0.85 versus 0.63). As mentioned previously, the cathode in cell D had a flaw that likely limited the loading. This flaw was a large folded-over metal region produced by the swaying process at NRL. The deloading of deuterium was very slow for both alloys, and required 17 days before a constant weight was observed. The final loading levels in Table 8 (0.85 and 0.63) are corrected for weight gains of the cathodes during electrolysis due to deposits of silicon and other impurities. It is interesting to note that the gradual increase in loading for cell C is consistent with the gradual increase in excess power for this experiment (Figure 21). The lack of excess power for cell D (Figure 22) is also consistent with its lower loading level (Table 8), the poor alignment of this cathode, and the detection of a major flaw in this electrode. Calorimetric errors would not likely lead to this solid agreement with other measurements and observations. In summary, this Pd-B alloy collaboration between China Lake and NRL produced one of our best heat and helium correlations (Table 3), a high success rate for excess power production (Figures 19 through 26), and some interesting loading studies (Tables 6 through 8). These Pd-B results could be a key to the reproducibility problem that has hindered progress for this field of research. The Pd-B rods, however, should be carefully examined prior to any experiments for flaws produced by any swaying operations on these very hard materials.

Table 6 presents loading studies by the weighing method for the 0.50 and 0.25 weight % B alloys. The loading of deuterium into the Pd-B alloys is slow and the loading levels

TABLE 6. Loading Studies by the Weighing Method Following 5 Days and 10 Days of Electrolysis.

Electrode	Xo, 5 days[a]	Xo, 10 days[b]
Cell A Pd-0.5% B (#94081701)	0.643	0.640
Cell B Pd-0.5% B (#94081702)	0.604	0.652
Cell C Pd-0.25% B (#94081801)	0.692	0.716
Cell D Pd-0.25% B (#94081802)	0.647	0.695

[a] I = 50 mA for 5 days.
[b] I = 100 mA for the second 5-day period.
NOTE: Microscopic examinations showed surface nicks and scratches but no major flaws on electrodes.

TABLE 7. De-loading Studies by the Weighing Method.

Time, hours	Pd-0.5% B, Cell A	Pd-0.5% B, Cell B	Pd-0.25% B, Cell C	Pd-0.25% B, Cell D
0	0.617	0.643	0.687	0.687
12	0.490	0.497	0.518	0.512
36	0.350	0.368	0.446	0.367
67	0.228	0.261	0.215	0.190
112	0.152	0.161	0.108	0.069
181	0.100	0.051	0.034	0.010
282	0.065	0.003	0.010	0.003

PALLADIUM WIRE STUDIES

One Johnson-Matthey sample (1-mm wire) had previously given both excess-heat and helium production at China Lake (see Table 3, cell B). There was an ample supply of this wire, hence experiments were planned for China Lake, NRL, the University of Utah, and Utah State University using this material. The same source of D_2O and lithium were to be used at each laboratory along with the same experimental procedures. The Pd-B alloy

TABLE 8. Loading Studies by the Weighing Method.

Time, days	Pd-0.75% B, Cell C	Pd-0.75% B, Cell D
7	0.580	0.550
12	0.614	0.594
100	0.85	0.63

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TABLE 9. Excess Power Expected for Various Electrode Sizes Assuming an Excess Power Density of 1 W/cm³ of Palladium.

Diameter, mm	Area, cm²	Px, W
1	0.64	0.016
2	1.29	0.063
3	1.95	0.141
4	2.64	0.251
6	4.05	0.565

NOTE: Palladium rods are 2.0 cm long. CalTech study: V = 0.073 cm³ (0.21 x 2.1 cm). MIT study: V = 0.071 cm³ (0.1 x 9 cm). Must scale cathode to yield Px of 3 σ or larger above calorimetric error. NAWCWPNS, 1 σ = ±0.02 W.

studies (Figures 23 through 28) and the palladium wire studies (Figures 29 through 35) represent the completion of all experiments outlined for our laboratory by our sponsor a tour final planning session in January 1995.

Four experiments using this palladium wire with our standard calorimeters (cells A, B, C, and D) were completed at China Lake as the final segment of our program. Excess power was obtained in one of these experiments. The calorimetric measurements for cells A, B. C, and D are shown in Figures 29 through 32, respectively. The excess-power effect was observed for cell C and peaked at about 300 mW or 10% above the input power. There was a consistent excess power effect for this cell (cell C) over most of the experiment. The power ratio for cell C is displayed in Figure 33. Turning the cell off for 3 days and then back on showed normal behavior, hence the excess power was not due to any calibration changes in the cell. A second calibration check for each cell was performed about 2 weeks later, as shown in Figures 29 through 33. The companion cell in the series (cell D) showed no consistent evidence for excess-power production. Similar experiments in cells A and B (Figures 29 and 30) produced no evidence for excess power that was clearly outside the range of experimental errors. The palladium cathodes in cells A and B were 2.5 cm in length (A = 0.40 cm², V = 0.020 cm³), while the cathode in cells C and D were 2.0 cm in length (A = 0.32 cm², V = 0.016 cm³). For the experiment in cell C, a rather large excess-power density of 15 W/cm³ was observed. These four experiments were all hindered by unusually large fluctuations in the cell voltages (±0.5 V) that were traced to a foaming problem in the D_2O-LiOD solutions. This foam would collect in the coils of the anode and then release. These four experiments all used D_2O supplied by NRL (Cambridge Isotope Laboratories, Lot No. PSO EH-283) and lithium foil supplied also by NRL (Alfa/Aesar Stock No. 10769). This shows that the D_2O can be an important uncontrolled variable in these experiments. The experimental protocol used in these experiments was to run at 100 mA/cm² for a day and then at 200 mA/cm² for 10 days. The normal operating current was 400 to 600 mA (1000 to 1500 mA/cm²). The higher current density used for these small cathodes is consistent with the higher power density (15W/cm³) obtained (Reference 5).

The improved China Lake calorimetry, shown in Figure 4 and discussed on page 10 in this report, was used in two studies of the 1-mm Johnson-Matthey wire (1 mm x 4.3 cm). One experiment showed several episodes of small excess power, while the other experiment showed only normal behavior. Two separate episodes of small excess power are shown in Figures 34 and 35. The onset of excess power in Figure 34 is sudden, and there is no clear trigger for this event. However, LiOD was added to the other cell in the series at about this same time. The loss of the excess-power effect in Figure 34 was also sudden, but this effect correlated to the addition of LiOD to both cells at 844 hours. This produced a decrease for the input power to the cell, hence a decrease in cell temperature. The excess power of 70 mW shown in Figure 34 corresponds to 2 W per cm³ of palladium. This is close to the excess power expected for a current density of 259 mA/cm² (References 5 and 6). Figure 35 shows a fluctuating excess power excursion later in this same experiment. McKubre et al. (Reference 1) also report fluctuations in excess power that appear to be correlated with oscillations of the cathode loading. The onset of the excess power in Figure 35 occurred shortly after a reduction in the heater power. The resulting change in the cell temperature may have triggered this excess-power event. The abrupt end to the excess-power fluctuations is not related to any known events. The results in Figures 34 and 35 show how this more sensitive calorimetry can be used to study events that may trigger or kill the excess-power effect. These types of studies are needed to gain an understanding of the anomalous heat production. The D_2O used in these experiments was obtained from NRL and from the same lot number that gave the foaming problem. Foaming did not appear to be a problem in the two experiments run in the sensitive calorimeters. The lithium used, however, was from a different source (FMC) than the lithium used where foaming was a problem. Studies at the University of Utah using D_2O from this same lot number also did not show any foaming problem. Perhaps the foaming was due to contamination of an isolated bottle of D_2O that was used to make up the LiOD solutions. Problems with foaming of D_2O-LiOD solutions have been reported by other investigators in this field and can, at times, be quite serious.

SUGGESTED PROCEDURES FOR EXCESS-HEAT PRODUCTION

The first consideration is the selection of an adequate calorimeter to detect any excess power. The calorimeter must be capable of measuring excess power in the range of 1 W per cm³ of the palladium cathode used. Table 9 presents expected excess-power levels for cathodes of various diameters and a length of 2.0 cm. A good choice would be the selection of a 4-mm-diameter cathode with a 2.0 cm length that would yield about 250 mW of excess power. The use of 1-mm-diameter wires would require very accurate calorimetry to detect the small levels of excess power expected.

The second consideration would be the testing of a variety of palladium or palladium alloy materials. Based on our experiments, Pd-B alloys should be included in these materials. Furthermore, cathodes that do not yield excess power on the first run should be tested a second time. Materials that show excess power should also undergo further testing in repeated experiments. All cathode materials should show smooth surfaces free from cracks and other defects. Careful examination of the electrode surface prior to an experiment can help avoid wasting valuable time investigating flawed materials.

Experiments should be run for an adequate period of time. Any excess enthalpy will generally be measurable within 2 to 3 weeks of the start of the experiment. However, some experiments required 6 weeks of electrolysis before any anomalous heat was detected. In general, 6 to 8 weeks of electrolysis should be allowed before judging that an experiment failed to produce excess power.

Current densities of 100 mA/cm² or larger should be used during the experiments. Smaller current densities (20 to 50 mA/cm²) can be used during the first week of the experiment. Changing the current density during the experiment may help to trigger the excess-heat effect. Low-current densities and cool-cell temperatures are likely favorable for deuterium loading early in the experiment where the loading process is exothermic. Higher cell temperatures will likely favor higher loading after formation of $PdD_{0.6}$ where the loading process apparently becomes endothermic (References 14 and 32).

A large stock of D_2O and lithium would be desirable to ensure that these variables remain constant for a series of experiments. Our experiments, however, have shown excess-power effects using a variety of D_2O lots and lithium sources. The effects of epoxy and silicon rubber remain undetermined based on our experiments. Our biggest excess power effect came from an experiment where epoxy was used. It would probably be wise to use a D_2O bubbler between the cell and oil bubbler. Some of our best results, however, were obtained in cells that vented the electrolysis gases directly into the atmosphere. General experimental procedures are presented elsewhere (Reference 33).

In summary, the selection of a calorimeter capable of measuring 1 W per cm³ of

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the cathode, the testing of a variety of cathode materials over 6 to 8 weeks of electrolysis, and the use of high-current densities after the initial loading should yield some experiments that show anomalous heat production.

DISCUSSION

Most of the palladium materials investigated at China Lake are summarized in Table 10. Distinct groupings of the success ratio are readily apparent based on the source of the palladium material. A high-success ratio is found for Johnson-Matthey materials where 17 out of 28 studies gave excess heat. The highest success ratio is for NRL Pd-B materials that showed excess power in seven out of eight experiments. Other NRL materials, however, gave poor results, such as NRL Pd-Ag (0/3) and NRL Pd (1/6). The single excess-heat result for NRL Pd involved a second run of the same cathode. Several other Pd and Pd-Ag sources failed to yield any excess heat-producing experiments. This polarization of successful experiments according to the palladium source would be very difficult to explain by random calorimetric errors. These results indicate that the metallurgical preparation of palladium is a major factor for observation of the excess enthalpy effect. A similar conclusion concerning reproducibility of the excess-power production has been reported by McKubre et al. (Reference 1) Our results suggest that the presence of B within the palladium may be a critical variable.

TABLE 10. Summary of Palladium Materials Tested for Excess Power.

Source	d, cm	V, cm^3	Px/V, W/cm^3	Success ratio	
NRL Pd-B (0.75%)	0.6	0.57	0.6	2/2	
NRL Pd-B (0.75%)	0.25	0.12	2.1	1/2	(7/8)
NRL Pd-B (0.50%)	0.40	0.25	0.4	2/2	
NRL Pd-B (0.25%)	0.40	0.25	0.8	2/2	
JM Pd	0.63	0.36	1.4	9/14	
JM Pd	0.63	0.67	0.3	1/1	
JM Pd	0.40	0.20	0	0/2	(17/28)
JM (F/P) Pd	0.20	0.038	3.1	1/1	
JM (F/P) Pd	0.10	0.012	14.0	1/1	
JM Pd	0.10	0.02	15.0	3/7	
JM Pd-Ce (F/P)	0.41	0.25	1.1	2/2	
NRL Pd	0.40	0.25	0.4	1/2	(2/5)
Tanaka Pd (sheet)	...	0.05	1.2	1/3	
NRL Pd	0.40	0.25	0	0/4	
NRL Pd-Ag	0.42	0.21	0	0/3	
IMRA Pd-Ag	0.40	0.20	0	0/2	(0/19)
WESGO Pd (1989)	0.14	0.09	0	0/6	
Pd/Cu	(0.63)	0.02	0	0/2	
John Dash Pd (sheet)	...	0.04	0	0/2	
Co-deposition (1992)	(0.63)	0.002	75	2/34	

The total excess enthalpy observed in various experiments is presented in Table 11. These values range up to 1,400 kJ for the longest periods of excess power. The complete combustion of all palladium within the cell and all the absorbed deuterium would only yield 6 to 7 kJ for the mass of palladium used, thus chemical reactions cannot explain the total excess enthalpy that was measured (Reference 33).

Our results present a striking correlation between the measured excess power and helium production in D_2O-LiOD electrolysis cells using palladium cathodes(Reference 25). The measured rate of helium production (10^{11} to 10^{12} ^{4}He/s•W) is the correct magnitude for typical fusion reactions that yield helium as a product.

TABLE 11. Total Excess Enthalpy in Various Experiments.

Year	Cathode	Excess enthalpy, kJ	Days/cell	Comments
1989	JM Pd (6.35 mm)	210	26/B	
1989	JM Pd (6.35 mm)	220	26/A	
1989	JM Pd (6.35 mm)	300	38/A	
1990	JM Pd (6.35 mm)	1,400	83/A	Helium, glass flasks, U of Texas
1991	JM Pd (6.35 mm)	48	11/B	Helium, glass flasks, Rockwell
1993	JM Pd (1 mm)	290	66/B	Helium, metal flasks, DOI[a]
1994	NRL Pd-B (6 mm)	950	137/B	Helium, metal flasks, DOI[a]

$2\ Pd_2D + 5/2\ O_2 \rightarrow 4\ PdO + D_2O$, $\Delta H = 6.2$ kJ for 4.3 g Pd

[a] Helium analysis by Department of Interior (DOI) Laboratory, Amarillo, Texas.

Three sets of heat and helium measurements have yielded similar results. Our first experiments (1990 to 1991) using Pyrex glass flasks resulted in eight experiments that yielded heat and helium, and six experiments that gave no excess power and no detectable helium. The helium measurements were performed at the University of Texas. Our second set of experiments (1991 to 1992) also used Pyrex glass flasks and involved three experiments that produced excess power and helium. The helium measurements were done by Rockwell International. Our final set of experiments (1993 to 1994) used metal flasks. Six experiments produced no excess power and only background levels of helium (Table 2). Seven experiments yielded excess power and helium production (Table 3). The helium measurements were performed by the U.S. Bureau of Mines, Amarillo, Texas.

The probability that all three sets of heat and helium measurements using palladium cathodes could be due to random errors is given by

$$P = P_1 \cdot P_2 \cdot P_3 = \left(\frac{1}{2}\right)^{14} \cdot \left(\frac{1}{2}\right)^{3} \cdot \left(\frac{1}{2}\right)^{13} = \frac{1}{1{,}073{,}741{,}800}$$

It is highly unlikely that our thirty experiments involving excess power and helium measurements could produce such consistent results due to random errors. There was only one valid experiment that yielded excess power but no helium above normal background levels. This was the Pd-Ce study shown in Figure 18, along with the two helium measurements presented in Table 5.

The inclusion of the two helium measurements for the Pd-Ce cathode (Table 5), along with the flawed excess heat measurement due to the low D2O level (sample 12/17/90-B, References 14 through 16), still yields an overwhelming probability against random errors expressed by

$$P = \frac{33!}{30!3!}\left(\frac{1}{2}\right)^{30} \bullet \left(\frac{1}{2}\right)^{3} = \frac{1}{1{,}574{,}402}$$

This calculation is for three mismatches, assuming a probability of exactly one-half for observing either excess heat or excess helium in any given sample.

The odds are, therefore, approximately one in a million that our complete set of 33 heat and helium results could be obtained from random experimental errors in our calorimetry and helium measurements. A more rigorous treatment in Appendix C gives the probability as one out of 750,000 for our set of 33 heat and helium results. Permanent laboratory records always defined the presence or absence of excess power prior to the helium measurements. Critics should carefully consider the probabilities presented in Equations 8 and 9 before dismissing this new science of anomalous effects in deuterated materials (Reference 34).

Significant levels of ^{4}He in deuterated palladium systems have also been report-

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ed by several other laboratories (Reference 22). These studies an agree with our initial report that the major fusion product is ^{4}He rather than ^{3}He (Reference 15). A recent study involving bombardment of palladium and titanium immersed in D_2O with intense ultrasound produced 4He levels greater than the normal atmospheric concentration (Reference 35). We report 18 experiments with excess power and elevated helium levels, along with 12 experiments showing no excess power and no excess helium. To our knowledge, there are no experimental errors that can explain these results.

Although radiation monitoring was a minor part of our program, the anomalous radiation observed in some experiments cannot be explained by any known error source. Anomalous radiation was detected by X-ray film exposure, by the use of several different GM detectors, and by the use of Nat detectors. There was never any anomalous radiation when the experiments were not running. Many experiments showed no unusual radiation counts. Anomalous radiation appeared within a few hours in co-deposition experiments where deuterium loading is rapid (Figure 8). The anomalous radiation always appeared much later when solid palladium or palladium ahoy cathodes was used (Figure 13). Similar radiation effects have been reported by S. Szpak et al. (Reference 28).

There was never any significant production of tritium in any of our experiments. A few experiments suggested low levels of tritium production (Table 1, see also Reference 22).

Progress on this program was hindered by two major approaches that failed to produce reproducible excess-heat effects. The first approach was the co-deposition method. Based on the small amount of palladium present in these experiments, excess heat could not be readily measured by our normal calorimetry. Nevertheless, carefully controlled plating processes in D_2O offer the possibility of reproducible palladium surfaces already loaded with deuterium that could yield anomalous effects without the long electrolysis times required for palladium rods (Reference 28). Further studies of this method using more sensitive calorimeters are warranted.

The second approach that hindered progress was the extended focus on NRL Pd-Ag and Pd cathodes. The deuterium loading was poor for these materials, hence excess-heat production was not likely. This is exactly what was observed by our calorimetric experiments. Success with NRL materials was finally achieved for Pd-B alloys, but these results apparently came too late to save this program. Even the NRL Pd-B materials often showed folded-over metal regions or other flaws that would likely act as cracks and prevent high loadings. Our calorimetry generally yielded excess enthalpy when palladium samples that yielded excess heat at other laboratories were tested and never yielded excess heat when samples that contained flaws or that showed poor loading characteristics were tested.

Some comments are necessary concerning the major disappointment that no excess power was measured in experiments conducted at NRL (Reference 36). The calorimeters at NRL were modified into a larger design to permit loading studies. This obviously changed the scaling of the cell, which is an important factor in these experiments (Reference 5). Furthermore, the room temperature control was very poor in the laboratory at NRL. Finally, the data acquisition system used at NRL did not average the cell potential. This large error source (±5%) is discussed on page 9. These factors led to a reported error of ±200 mW or larger (±10%) in experiments at NRL (Reference 36). Any excess power effect at NRL would have to be at least 600 mW to be clearly beyond experimental error. The excess-power effects observed at China Lake during this program would not have been detectable at NRL. As discussed previously, the calorimetry used in these experiments must be capable of readily detecting excess-power levels of 1W per cm3 of the palladium cathode (see Table 9). It should also be noted that the NRL calorimeters were primarily used to study NRL-prepared Pd-Ag and Pd materials. We never observed excess power in our studies of these same materials except for the single case of running an NRL Pd cathode a second time. No calorimetric studies of the promising Pd-B materials were completed at NRL. During the last year of this program, a very sensitive Seebeck calorimeter was placed in operation at NRL. Due to various problems, no valid experiment was completed at NRL using this new calorimetry. In conclusion, the calorimetric effort at NRL was indeterminate. No excess power was detected, but there were also no calorimetric experiments completed that were capable of measuring the levels of excess power obtained at China Lake. Thus the ratio of excess heat producing experiments at NRL to the number of valid experiments capable of detecting excess-power levels of 1 W per cubic centimeter of palladium was 0/0 or indeterminate.

SUMMARY

This field of anomalous effects in a deuterated system, which has come to be called "cold fusion," is a far more difficult research area than we might have thought 7 years ago. Progress at various laboratories around the world has not been as rapid as one might have hoped. Two technically challenging problems restrict progress (Reference 1):

1. **Irreproducibility**
2. **Scarcity of energetic (nuclear) products.**

Although we have not succeeded in solving the Reproducibility problem, our results indicate that helium-4 is the missing nuclear product. This ^{4}He is the most likely nuclear product that could have remained so well hidden during the past 7 years.

The remarkable correlation of excess power with the source of palladium in Table 10 cannot be easily explained by any calorimetric errors. Furthermore, 30 experiments at our laboratory have shown a correlation between either excess power and helium production or no excess power and no excess helium. It is highly unlikely that our heat and helium correlations could be due to random errors. Finally, our calorimetric results, conclusions, and problems are practically identical to those reported by the SRI laboratory (Reference 1). In our opinion, these factors provide compelling evidence that the anomalous effects measured in deuterated systems are real. Appendix D summarizes our experimental results that support this conclusion.

This research area has the potential to provide the human race with a nearly unlimited new source of energy. We hope that other scientists will continue to investigate this difficult research area until the challenging problems impeding progress are solved. It is still possible that anomalous effects in deuterated systems will prove to be one of the most important scientific discoveries of this century.

REFERENCES

1. M. C. H. McKubre, S. Crouch-Baker, A. K. Hauser, S. I. Smedley, F. L. Tanzella, M. S. Williams, and S. S. Wing. "Concerning Reproducibility of Excess Power Production," in *Proceedings of the Fifth International Conference on Cold Fusion*, 9-13 April 1995, Monte Carlo, Monaco, pp. 17-33.

2. M. C. H. McKubre, S. Crouch-Baker, R. C. Rocha-Filho, S. I. Smedley, and F. L. Tanzella, "Isothermal Flow Calorimetric Investigations of the D/Pd and H/Pd Systems," *J. Electroanal. Chem.*, Vol. 368 (1994), pp. 55-66.

3. D. E. Stilwell, K. H. Park, and M. H. Miles. "Electrochemical Calorimetric Studies on the Electrolysis of Water and Heavy Water (D2O)," *J. Fusion Energy*, Vol. 9(lg90), pp. 333-6.

4. M. H. Miles, K. H. Park, and D. E. Stilwell. "Electrochemical Calorimetric Evidence for Cold Fusion in the Palladium-Deuterium System," *J. Electron Chem.*, Vol.296 (1990), pp. 241-54.

5. M. Fleischmann, S. Pons, M. W. Anderson, L. J. Li, and M. Hawkins. "Calorimetry of the Palladium-Deuterium-Heavy Water System," *J. Electroanal. Chem.*, Vol. 287 (1990), pp. 293-348.

6. M. H. Miles, G. S. Ostrom, B. F. Bush, and J. J. Lagowski. "Experimental Evidence for Correlated Heat and Helium Production in Cold Fusion Experiments," in *Proceedings of the Symposium on Hydrogen Storage Materials, Batteries, and Electrochemistry*, Vol. 92-5, ed. by D. A. Corrigan and S. Srinivasan. Pennington, N.J., The Electrochemical Society, Inc., 1992. Pp. 287-97.

7. E. Storms. "Review of Experimental Observations About the Cold Fusion Effect," *Fusion Tech.*, Vol. 20 (1991), pp. 433-77.

New Energy Times Archive

8. "Cold Fusion Research. A Report of the Energy Research Advisory Board to the United States Department of Energy," John Huizenga and Norman Ramsey, Co-chairmen, November 1989, p. 12.

9. M. H. Miles, K. H. Park, and D. E. Stilwell. "Electrochemical Calorimetric Studies of the Cold Fusion Effect," in *Proceedings of the First Annual Conference on Cold Fusion*, 1990, Salt Lake City, Utah. Pp. 328-34.

10. M. C. H. McKubre, S. Crouch-Baker, A. M. Riley, S. I. Smedley, and F. L. Tanzella. "Excess Power Observations in Electrochemical Studies of the D/Pd System: the Influence of Loading," in *Frontiers of Cold Fusion*, ed. by H. Ikegami. Tokyo, Universal Academy Press, 1993. Pp. 5-19.

11. S. E. Jones and L. D. Hansen, "Examination of Claims of Miles et al. in Pons-Fleischmann-Type Cold Fusion Experiments," *J. Phys. Chem.*, Vol. 99 (1995), pp. 6966-72.

12. J. E. Jones, L. D. Hansen, S. E. Jones, D. S. Shelton, and J. M. Thorne. "Faradaic Efficiencies Less Than 100% During Electrolysis of Water Can Account for Reports of Excess Heat in Cold Fusion Cells," *J. Phys. Chem.*, Vol. 99 (1995), pp. 6973-9.

13. M. H. Miles, B. F. Bush, and D. E. Stilwell. "Calorimetric Principles and Problems in Measurements of Excess Power During Pd-D_2O Electrolysis," *J. Phys. Chem.*,Vol. 98 (1994), pp. 1948-1952. See also M. H. Miles and B. F. Bush. "Calorimetric Principles and Problems in Pd-D2O Electrolysis" in *Frontiers of Cold Fusion*, ed. by H. Ikegami, Tokyo, Universal Academy Press, 1993. Pp. 189-99.

14. M. H. Miles, R. A. Hollins, B. F. Bush, J. J. Lagowski, and R. E. Miles. "Correlation of Excess Power and Helium Production During D_2O and H_2O Electrolysis Using Palladium Cathodes," *J. Electroanal. Chem.*, Vol. 346 (1993), pp. 99-117.

15. B. F. Bush, J. J. Lagowski, M. H. Miles, and G. S. Ostrom. "Helium Production During the Electrolysis of D_2O in Cold Fusion Experiments," *J. Electroanal. Chem.*,Vol. 304 (1991), pp. 271-8.

16. M. H. Miles, B. F. Bush, G. S. Ostrom, and J. J. Lagowski. "Heat and Helium Production in Cold Fusion Experiments," in *The Science of Cold Fusion. Proceedings of the Second Annual Conference on Cold Fusion*, ed. by T. Bressani, E. Del Giudice and G. Preparata. Bologna, Italy, Italian Physical Society, 1991.Pp. 363-72.

17. M. Srinivasan. "Nuclear Fusion in an Atomic Lattice: An Update on the International Status of Cold Fusion Research," *Current Science*, Vol. 60 (1991), pp. 417-39.

18. M. H. Miles and R. E. Miles, "Theoretical Neutron Flux Levels, Dose Rates, and Metal Foil Activation in Electrochemical Cold Fusion Experiments," *J. Electroanal Chem.*, Vol. 295 (1990), pp. 409-14.

19. T. A. Chubb and S. R. Chubb. "Cold Fusion as an Interaction Between Ion Band States," *Fusion Technol.*, Vol. 20 (1991), pp. 93-99. See also S. R. Chubb and T. A. Chubb." Ion Band-State Fusion: Reactions, Power Density, and the Quantum Reality Question," *Fusion Technol.*, Vol. 24 (1993), pp. 403-16.

20. E. Pennisi, "Helium Find Thaws the Cold Fusion Trail," *Science News*, Vol. 139 (23 Mar1991), p. 180.

21. R. Dagani. "New Evidence Claimed for Nuclear Process in Cold Fusion," *Chem. Eng. News*, 1 April 1991, pp. 31-3.

22. M. H. Miles, B. F. Bush, and J. J. Lagowski. "Anomalous Effects Involving Excess Power, Radiation, and Helium Production During D_2O Electrolysis Using Palladium Cathodes," *Fusion Technol.*, Vol. 25 (1994), pp. 478-86.

23. M. H. Miles and B. F. Bush, "Search for Anomalous Effects Involving Excess Power and Helium During D_2O Electrolysis Using Palladium Cathodes," in *Frontiers of Cold Fusion*, ed. by H. Ikegami. Tokyo, Universal Academy Press, 1993. Pp. 189-99.

24. M. H. Miles and B. F. Bush, "Heat and Helium Measurements in Deuterated Palladium," in *Proceedings: Fourth Intentional Conference on Cold Fusion. Volume 2: Calorimetry and Materials Papers*, Report No. EPRI TR-104188Volume 2, Palo Alto, Calif., Electric Power Research Institute, July 1994. Pp. 6.16.7.

25. M. H. Miles and B. F. Bush. "Heat and Helium Measurements in Deuterated Palladium," *Transactions of Fusion Technol.*, Vol. 26 (December 1994), pp. 156-9.

26. S. Szpak, P. A. Mosier-Boss and J. J. Smith. "On the Behavior of Pd Deposited in the Presence of Evolving Deuterium," *J. Electroanal. Chem.*, Vol. 302 (1991), pp. 255-60.

27. H. Uchida, Y. Hamada, Y. Matsumura, and T. Hayashi. "Detection of Radioactive Emissions in the Electrolytic Deuteriding -- Dedeuteriding Reactions of Pd and Ti," in Frontiers of Cold Fusion, ed. by H. Ikegami. Tokyo, Universal Academy Press, 1993.Pp. 539-42.

28. S. Szpak, P. A. Mosier-Boss, and J. J. Smith. "On the Behavior of He Cathodically Polarized Pd/D System: Search for Emanating Radiation," *Physics Letters A*, Vol. 210(1996), pp. 382-90. See also Naval Command, Control and Ocean Surveillance Center-Naval Research and Development. Anomalous Behavior of the PAID System, by S. J. Szpak and P. A. Mosier-Boss. San Diego, Calif., NCCOSC-NRaD, September 1995. 180 pp. (NCCOSC NRaD Technical Report 1696, publication UNCLASSIFIED.)

29. S. Szpak, P. A. Mosier-Boss, and J. J. Smith. "Comments on Methodology of Excess Tritium Determinations," in *Frontiers of Cold Fusion*, ed. by H. Ikegami, Tokyo, Universal Academy Press, 1993. Pp. 515-8.

30. A. Takahashi, A. Mega, T. Takeuchi, H. Miyamaru, and T. Iida "Anomalous Excess Heat by D2O/Pd Cell Under L-H Mode Electrolysis," *Frontiers of Cold Fusion*, ed. by H. Ikegami. Tokyo. Universal Academy Press, 1993. Pp. 74-91.

31. B. F. Bush and M. H. Miles. "Practical Aspects of Heat and Helium Measurements in Deuterated Palladium," in *Cold Fusion Source Book, Proceedings of the International Symposium on Cold Fusion and Advanced Energy Sources*, ed. by H. Fox. Minsk, Belarus, 24-26 May 1994. See also Cold Fusion Symposium, Minsk, 1994, pp. 349-356.

32. J. Balej and J. Divisek. "Energy Balance of D_2O Electrolysis with a Palladium Cathode, Part I. Theoretical Relations," *J. Electroanal Chem.*, Vol. 278 (1989), pp. 85-98.

33. M. H. Miles. "The Extraction of Information From an Integrating Open Calorimeter in Fleischmann-Pons Effect Experiments," in *Proceedings of the Fifth International Conference on Cold Fusion*, 9-13 April 1995, Monte Carlo, Monaco. Pp. 97-104.See also E. Storms. "How to Reproduce the Pons-Fleischmann Effect," *Fusion Tech.*, Vol. 29 (1996), pp. 261-8.

34. M. H. Miles. "Reply to Examination of Claims of Miles et al. in Pons-Fleischmann Type Cold Fusion Experiments," J. Phys. Chem. (submitted).

35. R. Stringham and R. George. "Cavitation Induced Solid State Production of Heat, ^3He, and ^4He," in Book of Abstracts, 209 th ACS National Meeting, 2-6 April 1995, Anaheim, Calif., NUCL 044.

36. Naval Research Laboratory. *A Summary of NRL Research on Anomalous Effects in Deuterated Palladium Electrochemical Systems*, by D. D. Dominguez, P. L. Hagans, and M. A. Imam, Washington, DC, NRL, 9 January 1996. 132 pp. (NRL/MRJ617096-7803, publication UNCLASSIFIED.)

Appendix B

ROOM TEMPERATURE CORRECTION

$$P=K_t(T_b-T_R) + K\Delta T \qquad \text{(A-1)}$$

Correction is needed that makes the measured power output at any bath and room temperature to be the same as when the measurements are made for T_b = 27.50°C and T_R = 23.50° C.

thus

$$P(T_b, T_R) = P(27.50°C, 23.50°C)$$

From Equation A-1

$$K_t(T_b-T_R)+K\Delta T_{obs} = K_t(27.50-23.50) + K\Delta T$$

or

$$K_t(T_b-T_R)+K\Delta T_{obs} = K_t(4.00) + K\Delta T$$

solving for ΔT

$$\boxed{\Delta T = \Delta T_{obs} + K_t K^{-1}(T_b-T_R-4)}$$

Appendix C

PROBABILITIES OF EXPERIMENTAL HEAT AND HELIUM CORRELATIONS

For our 33 experiments involving heat and helium measurements, excess heat was measured in 21 cases and excess helium was observed in 18 studies. Thus 12 experiments yielded no excess heat and 15 measurements gave no excess helium. If one uses these experimental

Appendix A

TEMPERATURE-DEPENDENT CALORIMETRIC PARAMETERS

$$C_{P,D_2} = 28.9778 - 1.49226 \times 10^{-3}\,T + 4.14779 \times 10^{-6}\,T^2 + 0.26544 \times 10^5\,T^{-2} \ (\mathrm{J\,mol^{-1}\,K^{-1}})$$

$$C_{P,O_2} = 23.1436 + 18.2628 \times 10^{-3}\,T - 6.605 \times 10^{-6}\,T^2 + 1.2118 \times 10^{-5}\,T^{-2} \ (\mathrm{J\,mol^{-1}\,K^{-1}})$$

$$C_{P,D_2O(g)} = 26.7006 + 21.2897 \times 10^{-3}\,T - 2.66774 \times 10^{-6}\,T^2 + 1.2907 \times 10^5\,T^{-2} \ (\mathrm{J\,mol^{-1}\,K^{-1}})$$

$$C_{P,D_2O(liq)} = 200.13 - 495.9 \times 10^{-3}\,T + 573.07 \times 10^{-6}\,T^2 - 16.765 \times 10^5\,T^{-2} \ (\mathrm{J\,mol^{-1}\,K^{-1}})$$

$$L_{D_2O(liq)} = 85263.9 - 173.429\,T + 0.2586\,T^2 - 1.91913 \times 10^{-4}\,T^3 - 1805569\,T^{-1} \ (\mathrm{J\,mol^{-1}})$$

$$\log P^0_{D_2O} = 35.47686 - 3343.93\,T^{-1} - 10.9 \log T + 0.0041645\,T + 9.14056 / (197.397 - T)$$

$$P = (0.98\,P^0_{D_2O})\,P^*$$

$$E_H = 1.5318346 - 0.0002067\,(T - 273.15)\ (V)$$

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results as random probabilities of P_h = 21/33 for excess heat and P_{He} = 18/33 for excess helium, then the probability of random agreement (P_a) for our heat and helium measurements would be

$$P_a = P_h \cdot P_{He} + (1-P_h)(1-P_{He}) = 0.512$$

and the probability of random disagreement (Pd) would be Pd = 1 - P_a = 0.488. The presence or absence of excess heat was always recorded prior to the helium measurement and was not communicated to the helium laboratory. Based on our experimental results, the random probability of the helium measurement correlating with the calorimetric measurement is not exactly one-half. This is analogous to flipping a weighted coin where heads are more probable than tails. The probability of exactly three mismatches in 33experiments, therefore, would be

$$P_3 = (30!/30!3!)\ (0.512)^{30}(0.488)^3 = 1.203 \times 10^{-6}$$

Similar terms can be calculated for two (P_2 = 1.221 x 10^{-7}), one (P_1 = 8.009 x 10^{-9}), or zero (P_0 = 2.546 x 10^{-10}) mismatches in 33 experiments. The total probability of three or less mismatches in 33 studies would be

$$P = P_3 + P_2 + P_1 + P_0 = 1.333 \times 10^{-6} = 1/750{,}000$$

This statistical treatment shows that the odds are approximately one in 750,000 that our complete set of heat and helium results could be this well correlated due to random experimental errors in our calorimetry and helium measurements. Furthermore, it is very unlikely that random errors would consistently yield helium-4 production rates in the appropriate range of 10^{11} - 10^{12} atoms/s per watt of excess power.

EVIDENCE SUPPORTING ANOMALOUS EFFECTS

CALORIMETRIC EVIDENCE

1. The correlation of excess power with cathode materials (Table 10).

2. Magnitude of excess power agrees with SRI and other laboratories.

3. Excess power density agrees with SRI and other laboratories (1-5 W/cm^3 Pd for current densities of 100-200 mA/cm^2).

4. Reproducibility problem is similar to other laboratories for excess heat production.

5. The precise detection and correction for apparent excess power due to recombination effects in co-deposition experiments (see Figure 6).

6. The high-success ratio for excess power using Pd-B materials prepared by NRL.

7. The low-success ratio for excess power using NRL Pd-Ag and NRL Pd samples that showed poor loading.

8 . The low-success ratio for excess power in co-deposition experiments where the volume of dense palladium was very small.

9. Correlation between excess power and loading measurements for NRL Pd-B samples (see Figures 21 and 22 and Table 8).

10. High-success rate (4/4) for excess power using materials supplied by Martin Fleischmann. This demonstrates reproducibility between laboratories when good cathode materials are identified.

11. The low-success rate for palladium-plated cathodes where the palladium volume is small.

12. Agreement with other laboratories on electrolysis time periods and current densities required for excess power production.

13. No excess power in twelve H_2O + LiOH control experiments.

14. High-success rate for excess power in repeated experiments using the same cathode.

HEAT AND HELIUM EVIDENCE

1. The correlation of excess heat and helium production or no excess heat and no excess helium in 30 experiments.

2. Magnitude of excess helium yields helium production rates of 10^{11} - 10^{12} atoms per second per watt of excess power that is consistent with typical deuteron fusion reactions.

3. Agreement between three different laboratories that performed helium measurements on our samples.

4. Agreement between samples collected in both glass and metal flasks.

5. Resolution of the helium detection limit question that is consistent with background helium levels determined later and with the known rate of helium diffusion through glass.

6. No excess power and no excess helium in seven H_2O + LiOH control studies.

7. Excellent agreement for background helium levels when no excess power was measured and metal flasks were used to collect samples (4.5 + 0.5 ppb ^{4}He).

8. Reports from other laboratories for helium-4 production in deuterated palladium systems.

ANOMALOUS RADIATION EVIDENCE

1. Exposure of X-ray films in two experiments producing excess power. No exposure of similar films in many experiments where no excess power was present.

2. Anomalous high counts for several different GM detectors when experiments were running.

3. No anomalous count rates when experiments were turned off.

4. Anomalous high counts for NaI detectors.

5 . Correlations of anomalous radiation with expected time periods required to load the palladium with deuterium.

6. More rapid appearance of anomalous radiation in co-deposition experiments.

7. Decrease in anomalous radiation when the detectors were moved away from the electrolysis cells. This was observed on many occasions.

TRITIUM PRODUCTION EVIDENCE

1. Somewhat higher levels of tritium than expected from theoretical calculations in a few experiments.

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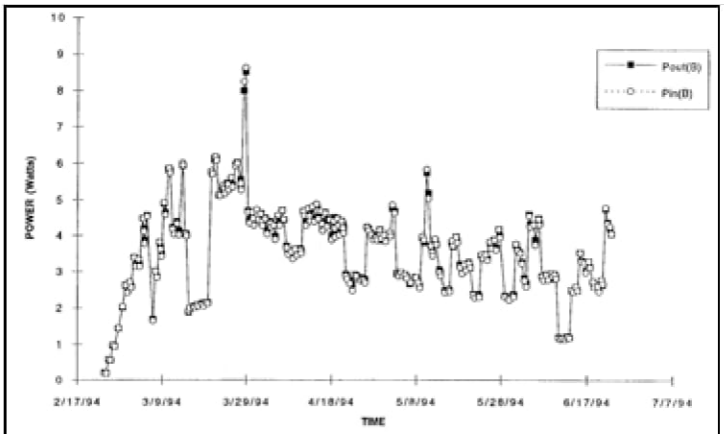

FIGURE 1. Electrochemical Input Power and Calorimetrically Measured Output Power for an NRL Palladium Cathode That Produced No Excess Power, Cell D.

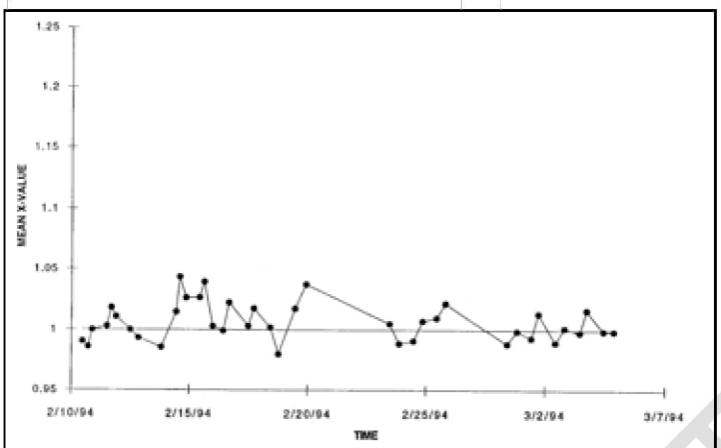

FIGURE 2. Ratio, X, of the Calorimetric Output Power and the Electrochemical Input Power for a Palladium Sheet Cathode Obtained From John Dash (Professor, Portland State University), Cell B. No significant excess power was observed.

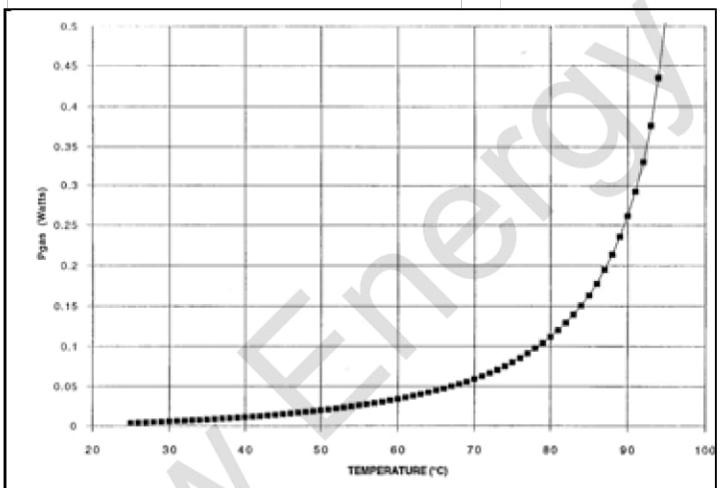

FIGURE 3. Theoretical Effect of the Cell Temperature on the P_{gas} Term (Equation 2) When I = 0.500 A and the Bath Temperature is 27.50°C.

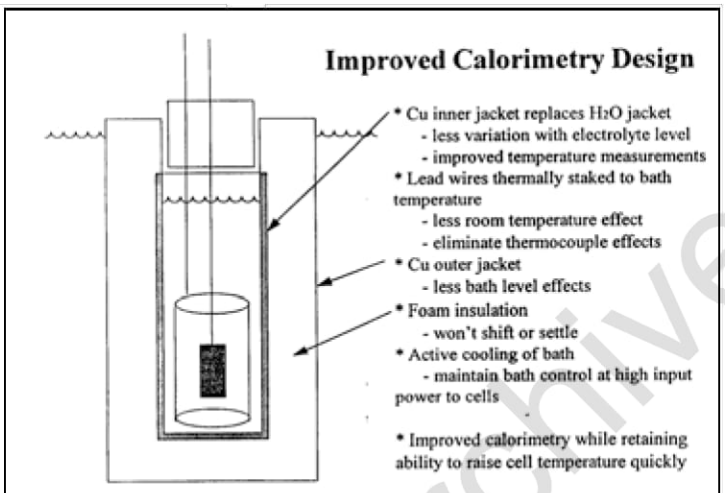

FIGURE 4. Improved Design for Integrating Open, Isoperibolic Calorimeters Constructed at China Lake in 1994.

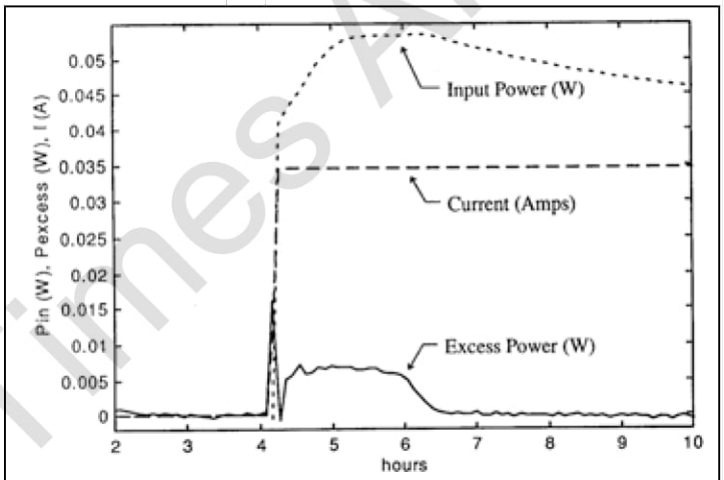

FIGURE 5. Measurement of the Exothermic Heat of Absorption of Deuterium Into a Palladium Wire (1 mm x 4.3 cm) Using the New Calorimeter Developed at China Lake.

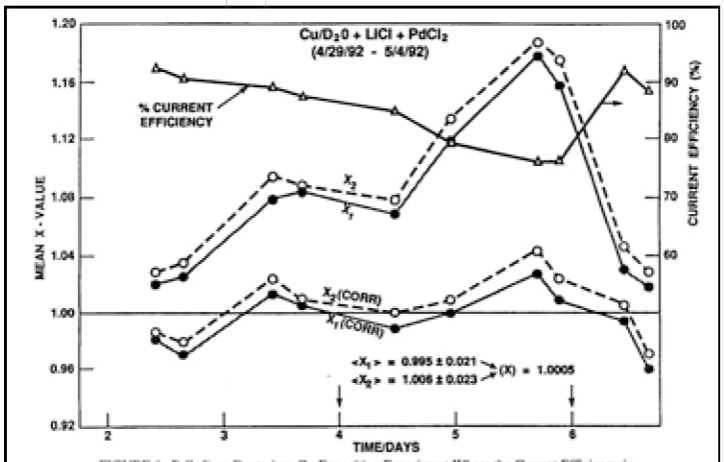

FIGURE 6. Palladium-Deuterium Co-Deposition Experiment Where the Current Efficiency is Significantly Less Than 100%. No significant excess power is observed after correcting for the experimental current efficiency (γ).

LETTERS—continued from page 9.

accomplished that both the general public, and many who should be interested, seem to be totally unaware of. Your article will hopefully begin to correct that, and I am interested in looking over a few back issues of *Infinite Energy* and expect to subscribe, provided I find some of the material understandable given the background I cited above.

I wish we had Dr. Asimov still with us; he was a master at taking complex scientific ideas and making them clear to the interested layman. This work cries out for that kind of treatment! (If I don't understand what you send I'll show it to those who can!)

I was struck by two things in your presentation. One, we don't know yet why the Cold Fusion concept works, and two, in spite of carefully organized experiments at competent laboratories throughout the world, the results are still wildly non-uniform, one of them fatally so. This tells me we can look forward to very large improvements in efficiency and output power as the process becomes better understood, but that one must beware of inadvertently approaching a real power breakthrough once the elements start to come together, possibly triggering an avalanche effect. Too early commercialization before reliabil-

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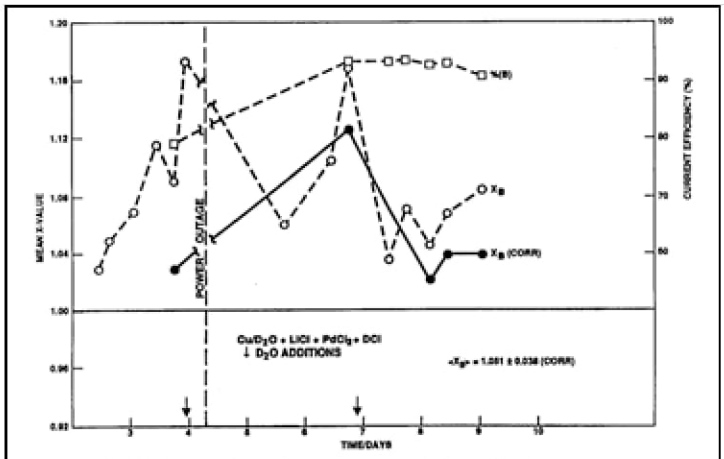

FIGURE 7. Palladium-Deuterium Co-Deposition Experiment Where Significant Excess Power Remains Even After Correcting for the Current Efficiency (γ).

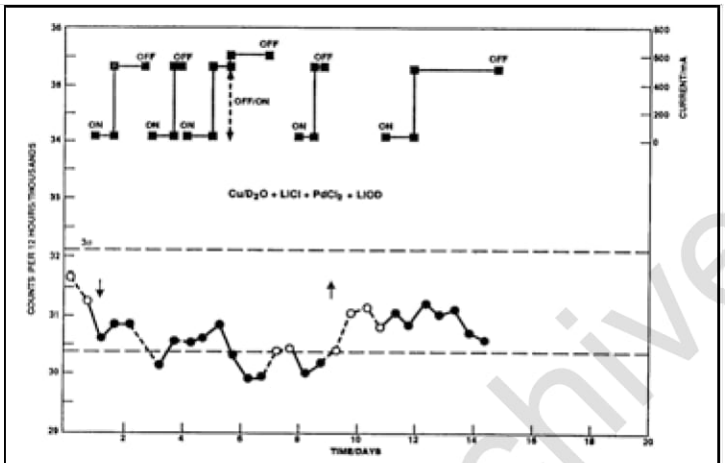

FIGURE 10. Five Successive Palladium-Deuterium Co-Deposition Experiments That Showed No Anomalous Radiation. The same GM Detector as in Figures 8 and 9 was used. NRL X-ray and germanium detectors placed near the cells also showed no anomalous radiation.

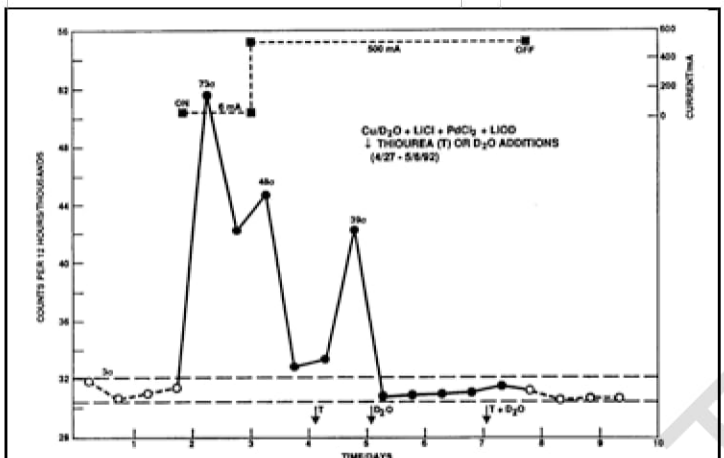

FIGURE 8. Anomalous Radiation Counts Observed During a Palladium-Deuterium Co-Deposition Experiment.

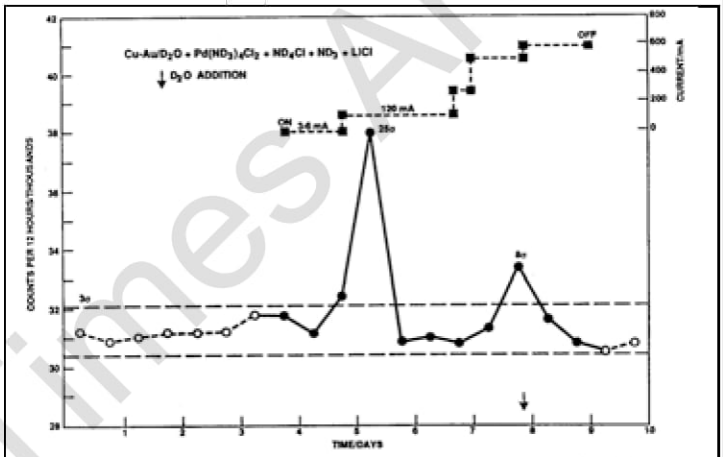

FIGURE 11. Modified Palladium-Deuterium Co-Deposition Experiment Using Palladous Amine Chloride in a $ND_4Cl + ND_3$ Buffer Solution. Anomalous radiation was observed using the same GM Detector as in Figures 8-10.

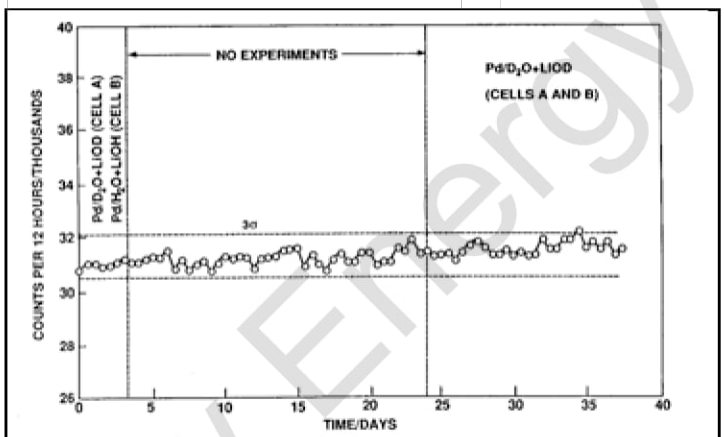

FIGURE 9. Normal Radiation Counts Observed During Periods of Electrolysis Experiments and No Experiments. The same Geiger-Mueller (GM) Detector as in Figure 8 was used.

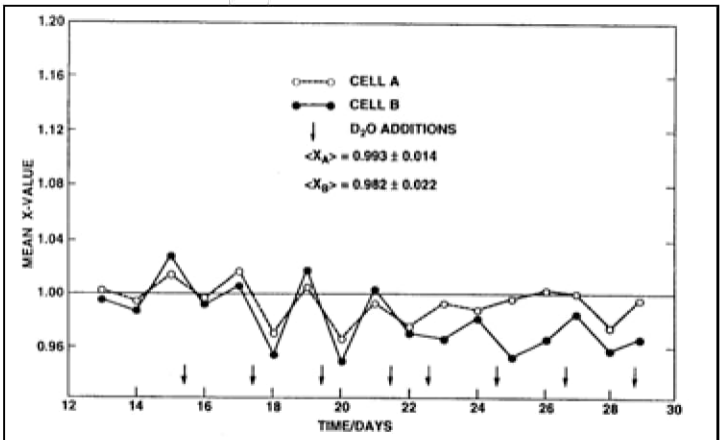

FIGURE 12. Two Calorimetric Studies in Cells A and B of NRL Pd-Ag Alloy Cathodes That Showed No Excess Power.

ity is established could be counter-productive, leading to lawsuits and bad press, etc.

I have relatives near Manchester, NH and visit them occasionally. Perhaps we could get together?

Don C. Maier,
Enterprise, Alabama

Don, thank you for your kind appreciation. Your assessment of the situation with commercialization is right on. You might wish to know, however, that Isaac Asimov went to his grave not believing that the evidence for cold fusion was substantial. Sadly, the great man had been sold a bill of bad goods by cold fusion's enemies. We hope that in our more lucid moments we can make matters as clear as he could when he had the proper information at hand.—EFM

• — • — •

The CETI ads have looked inviting, so I just recently sent a letter to Mr Christian Ismert of CETI in Sarasota, FL. The letter was an inquiry as to how I can be involved with CETI in a whatever mutually beneficial manner. Not certain how best to pose the question, I just pointedly asked for his suggestions.

After nearly 20 years as a self-employed physics consultant in diagnostic radiology, I am now most absolutely and quite THOROUGHLY BORED with "standard" physics and the "standard stuffy physicists" that are in the field. I feel like I am burned at the stake anytime I even touch on the subject of alternate energy. Innovative thinking is why I became self-employed decades ago.

I would love to be a part of the "new ener-

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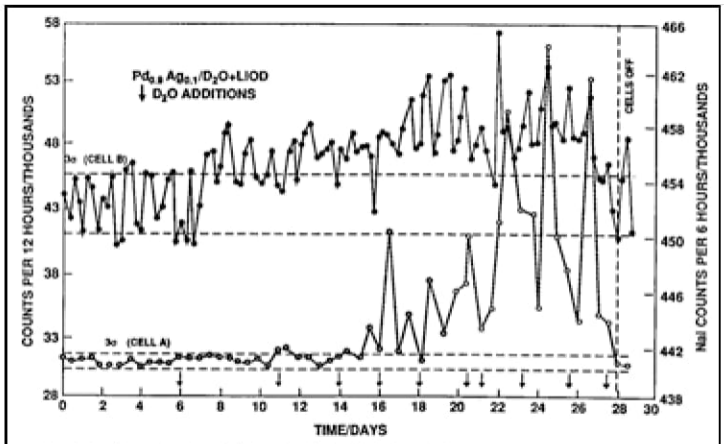

FIGURE 13. Anomalous Radiation During the NRL Pd-Ag Alloy Experiments Using Two Different Detectors. Both the GM detector (bottom curve) and the sodium iodide detector (top curve) show anomalous radiation after 8-15 days of electrolysis.

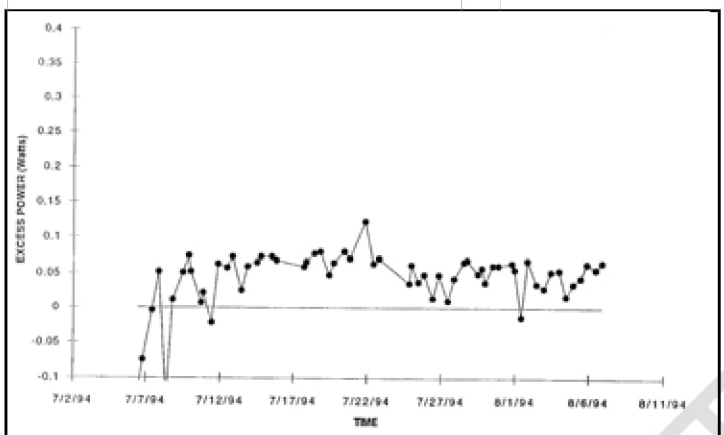

FIGURE 14. Excess Power Observed for an NRL Palladium Cathode in a Second Experiment, Cell D. This represents the only study showing excess power using NRL palladium cathodes.

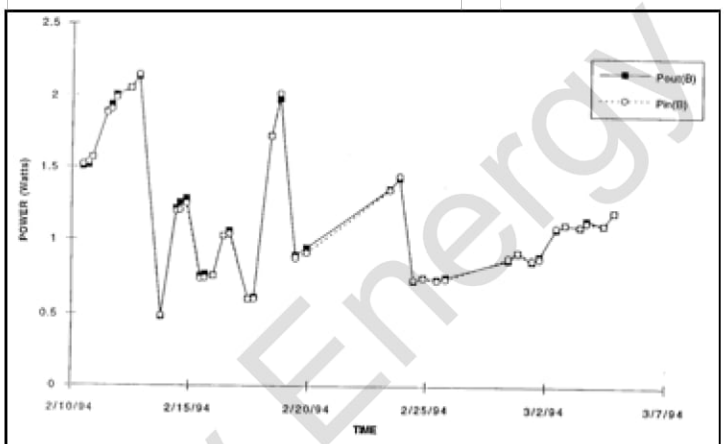

FIGURE 15. The Electrochemical Input Power and the Calorimetrically Measured Output Power for a Palladium Sheet Cathode Supplied by John Dash, Cell B. No excess power was observed.

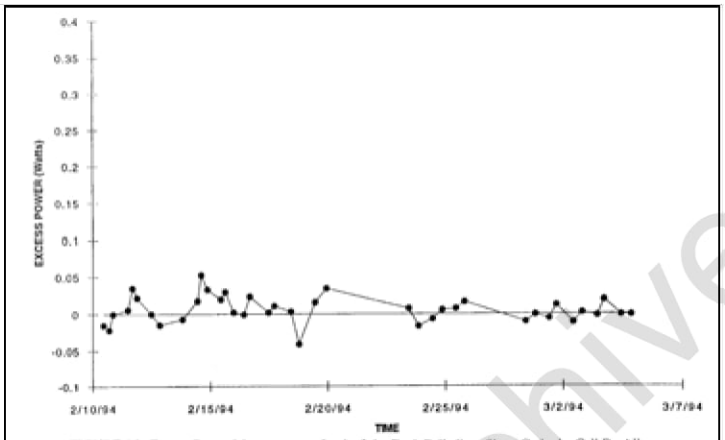

FIGURE 16. Excess Power Measurements for the John Dash Palladium Sheet Cathode, Cell B. All measurements are within ±40 mW. No excess power was observed.

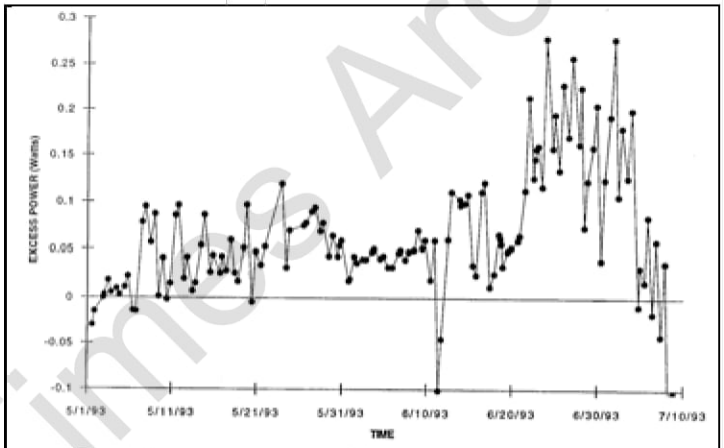

FIGURE 17. Excess Power Measurements for the 2-mm Palladium Rod Obtained From Martin Fleischmann, Cell D. Excess power peaks as large as 250 mW were observed later in this experiment.

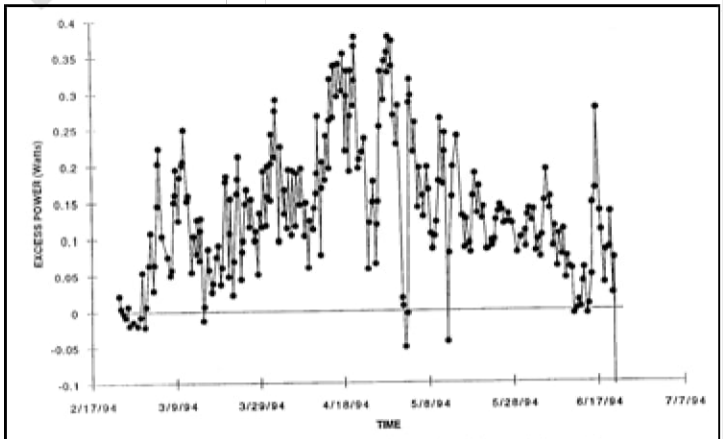

FIGURE 18. Excess Power Measurements for a Palladium-Cerium Alloy Rod (4.1 mm x 1.9 cm) Obtained From Martin Fleischmann, Cell C. Excess power peaks of 350 mW were observed.

gy" and adapt my business, entrepreneurial, and physics skills to promote such. The possibly available hot water heating CETI device with the 20 to 50% excess may be the catalyst for my change.

Also some questions for you: GEET Technology: How may I get info from that group as to retrofitting automobiles? I certainly would like to educate myself on this. Possible purchase from individuals plans, components, etc.

Carbon-Arc: I have a lot of instrumentation, components doing nothing. Where can I get some "cookbook" directions for carbon arc experiments. Is there a back issue covering such? Do you have such material?

Gene, your publication is outstanding. I can see that you love what you do ! ! I carry tall the publications in my car and read, re-read, etc, until I have covered nearly every printed word.

I will send a new subscription order, even though I am current, after your e-mail response. Just in case you have some suggested material to assist me in my "info quest" that I may wish to purchase.

Dave Milam

Gosh, lots of questions, which I hope I answered in an e-mail response—lots of those resource addresses are sprinkled through our issues. You can find them if you look carefully enough. It is good to know Infinite Energy *is having such a profound effect on people's lives.—EFM*

• — • — •

Dear Gene:

Thank you so much for meeting with me and Angela last Friday, September 12th. I cherish the infrequent contacts with fellow energy pioneers.

Enclosed is a new copy of my paper entitled, "A Unity Engine," dated 16 Sep 97. It

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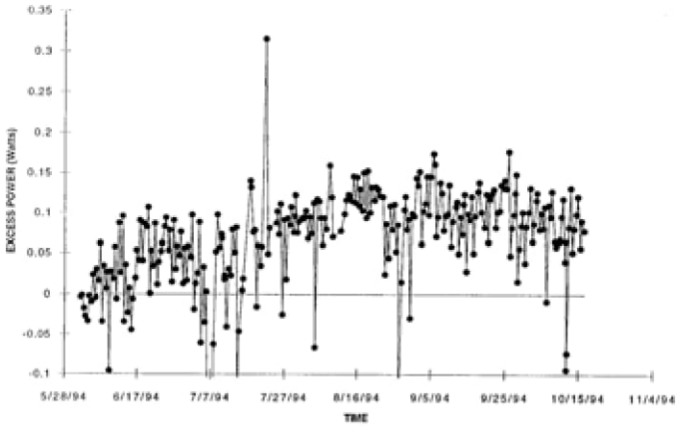

FIGURE 19. Excess Power Measurements for an NRL Palladium-Boron Rod (6.0 mm x 2.0 cm, 0.75 weight % boron), Cell B.

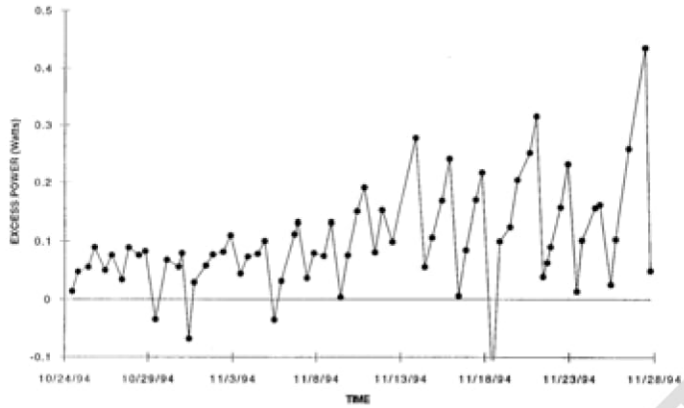

FIGURE 20. Excess Power Measurements for a Second Experiment Using the Same Palladium-Boron Rod as in Figure 19, Cell B.

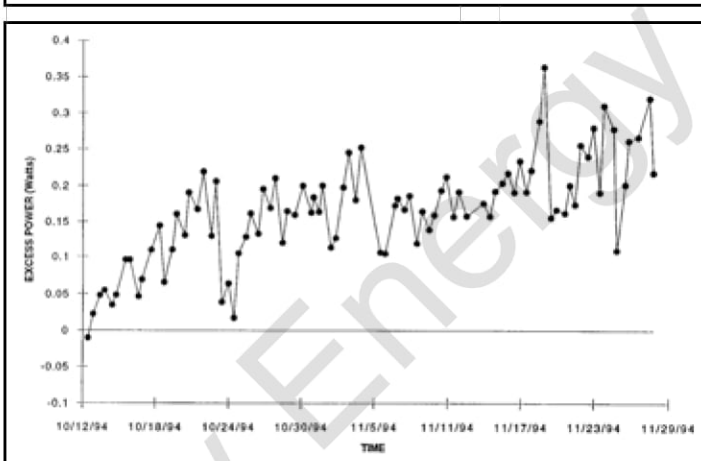

FIGURE 21. Excess Power Measurements for an NRL Palladium-Boron Rod (2.5 mm x 2.5 cm, 0.75 weight % boron), Cell C. A gradual increase in the excess power was observed. No flaws were visible for this cathode.

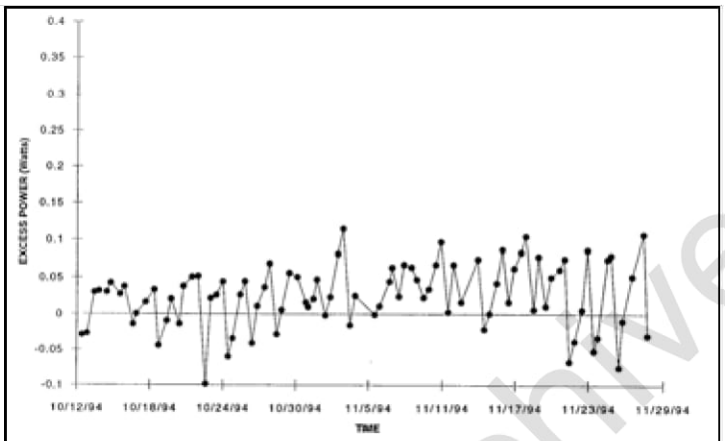

FIGURE 22. Experiment Showing No Significant Excess Power for an NRL Palladium-Boron Rod (2.5 mm x 2.5 cm, 0.75 weight % boron), Cell D. This rod contained a folded-over metal region that would act as a long crack.

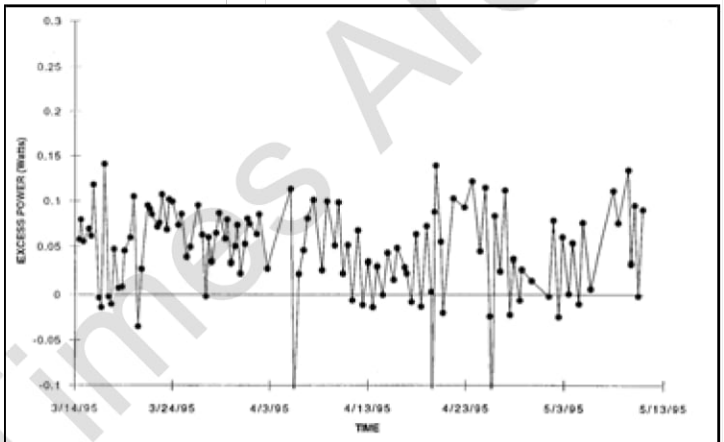

FIGURE 23. Excess Power Measurements for an NRL Palladium-Boron Rod (4.0 mm x 2.0 cm) Containing 0.50 Weight % Boron, Cell A. Excess power levels of 50-150 mW were observed.

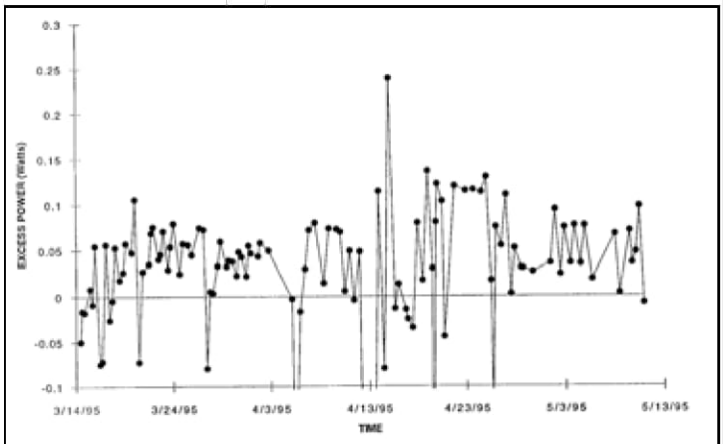

FIGURE 24. Excess Power Measurements for Another NRL Palladium-Boron Rod (4.0 mm x 2.0 cm) Containing 0.50 Weight % Boron, Cell B. Typical excess power levels are 50-150 mW.

has been rewritten for better clarity and readability. **[see this issue, page 109]**

Thanks for the complementary copies of *IE* #13. It has been in my hands every day. As you suspected and I initially did not recognize, the article, "Work In Constant Entropy Systems," by Remi Cornwall, is close to the ideas behind my thermodynamic cycle. I have not thought of my engine in the way he predicts "first order phase change perpetuum mobiles," but the generalities apply. The article is just sinking in and I will study it in detail. Corroboration is nice. I too think we are experiencing an unstoppable wave of awareness and development of new energy.

I disagree with Remi Cornwall's statement that Nyquist noise cannot produce useful electrical work. See Joseph Yater's solid state heat engine, US patent #4,004,210, discussed in *Physical Review A*, Vol. 10, pp.1361-1369, Vol. 18, pp. 767-772, Vol. 20, pp.623-627, Vol. 20, pp. 1614-1618, Vol. 26, pp. 522-538, and Vol. 26, pp. 2954-2967. It relies upon silicon semiconductor integrated circuitry with diode circuit elements of dimensions on the order of 0.01 microns, or 100 Angstroms, the mean free path of an electron in the semiconductor moving about by thermal energy. Since semiconductor technology has not progressed to this level that I know of, this invention has not been possible to build yet.

Ken Rauen
Gregory, Michigan

Thanks, Ken. I'm sure that Remi Cornwall would like to reply. Oh, no, you mean we are going to lose "Conventional Thermodynamics" too?!—EFM

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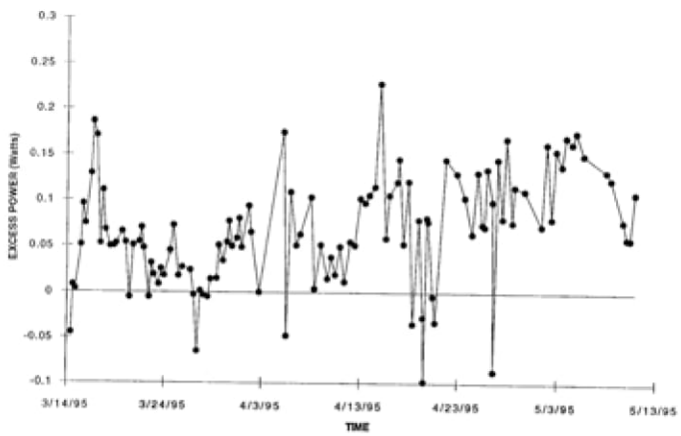

FIGURE 25. Excess Power Measurements for an NRL Palladium-Boron Rod (4.0 mm x 2.0 cm) Containing 0.25 Weight % Boron, Cell C. Typical excess power levels are 50-150 mW.

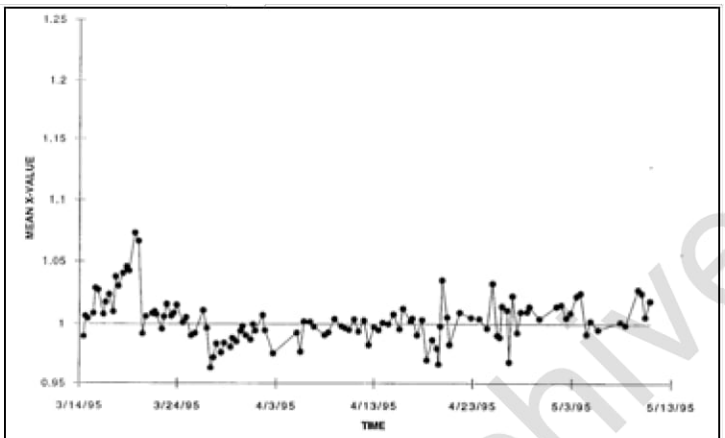

FIGURE 28. Ratio, X, of Output and Input Power for the Experiment Shown in Figure 26, Cell D. No excess power is measured except for early in the experiment.

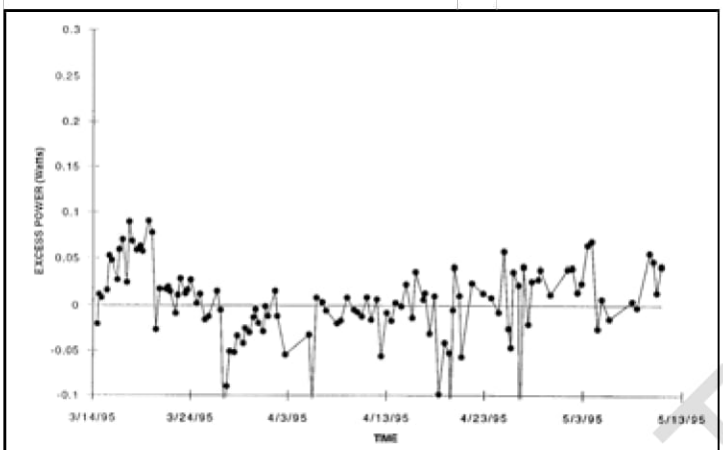

FIGURE 26. Excess Power Measurements for Another NRL Palladium-Boron Rod (4.0 mm x 2.0 cm) Containing 0.25 Weight % Boron, Cell D. A brief 5-day period of excess power was observed early in the experiment.

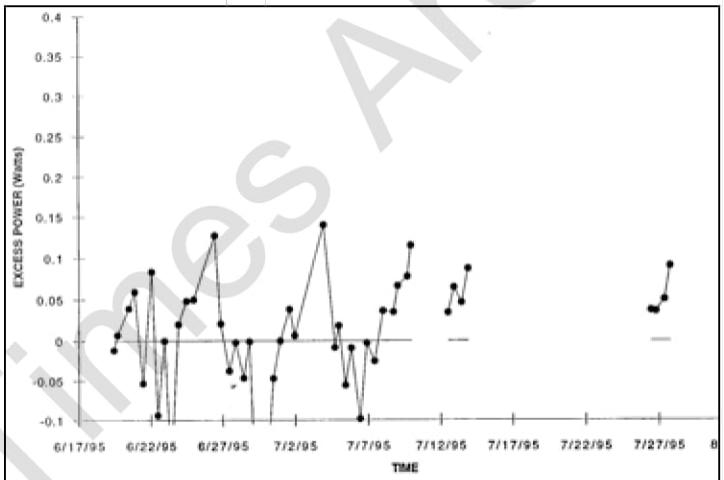

FIGURE 29. Excess Power Measurements for the Johnson-Matthey Palladium Wire (1 mm x 2.5 cm) Cell A. Calibrations following this experiment suggest no excess power.

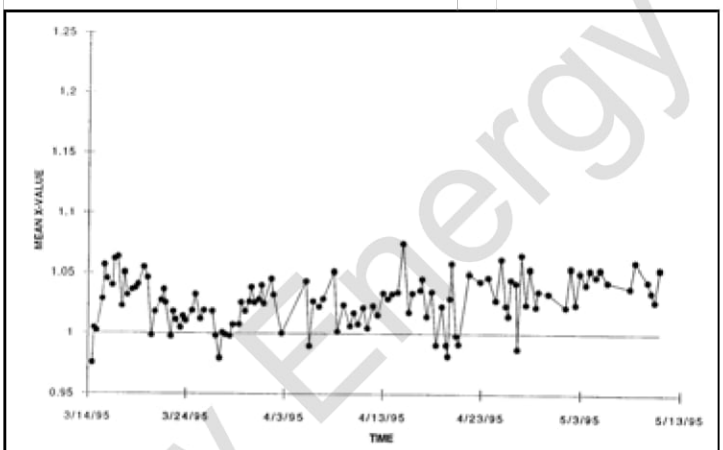

FIGURE 27. Ratio, X, of Output and Input Power for the Experiment Shown in Figure 25, Cell C.

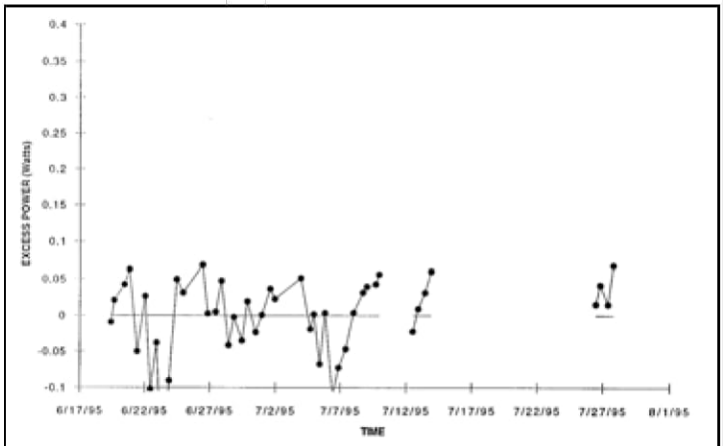

FIGURE 30. Excess Power Measurements for Another Johnson-Matthey Palladium Wire (1 mm x 2.5 cm), Cell B. No significant excess power was observed.

•—•—•

FYI:
Just out:

Millis, M. (1997) "The Challenge to Create the Space Drive," in *Journal of Propulsion & Power*, Vol. 13, No. 5, Sept.-Oct. 1997, pp. 577-582.

Abstract

To travel to our neighboring stars as practically as envisioned by science fiction, breakthroughs in science are required. One of these breakthroughs is to discover a self-contained means of propulsion that requires no propellant. To chart a path toward such a discovery, seven hypothetical space drives are presented to illustrate the specific unsolved challenges and associated research objectives toward this ambition. One research objective is to discover a means to asymmetrically interact with the electromagnetic fluctuations of the vacuum. Another is to develop a physics that describes inertia, gravity, or the properties of spacetime as a function of electromagnetics that leads to using electromagnetic technology for inducing propulsive forces. Another is to determine if negative mass exists or if its properties can be synthesized. An alternative approach that covers the possibility that negative mass might not exist is to develop a formalism of Mach's Principle or reformulate ether concepts to lay a foundation for addressing reaction forces and conservation of

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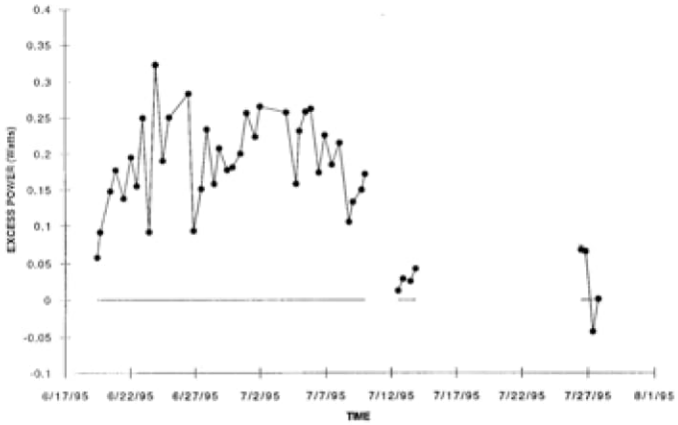


FIGURE 31. Excess Power Measurements for a Third Johnson-Matthey Palladium Wire (1 mm x 2.0 cm), Cell C. Significant excess power exceeding 200 mW was consistently observed. Calibrations checks following this experiment verify the excess power observations.

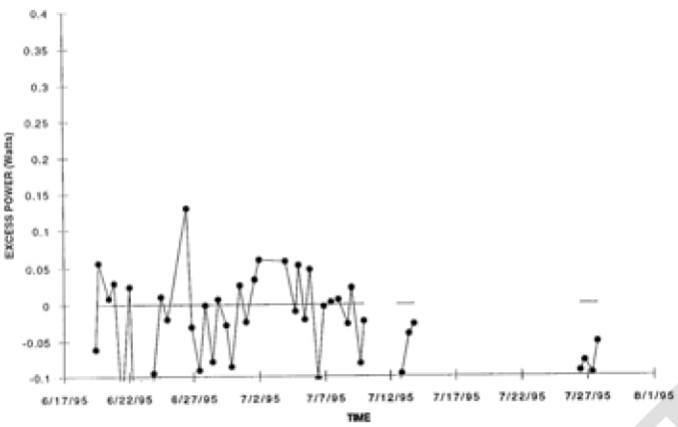


FIGURE 32. Excess Power Measurements for a Fourth Johnson-Matthey Palladium Wire (1 mm x 2.0 cm), Cell D. No significant excess power was observed. The calibration checks following this experiment, however, suggest a possibility of small excess power effects.

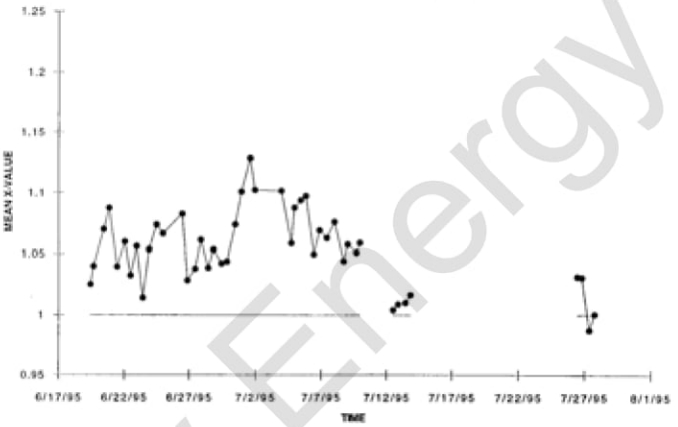


FIGURE 33. The Power Ratio, X, for the Experiment in Figure 31 That Produced Significant Excess Power, Cell C.

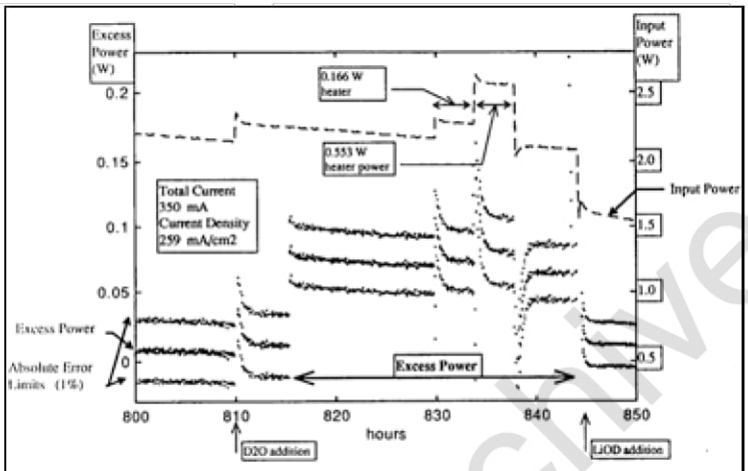


FIGURE 34. Excess Power Excusion for a 1-mm Johnson-Matthey Wire Cathode (1 mm x 4.3 cm) as Measured With the Improved China Lake Calorimeter. Excess power levels of approximately 75 mW are observed from 815 to 845 hours. Both the onset and the loss of the excess power effect were sudden.

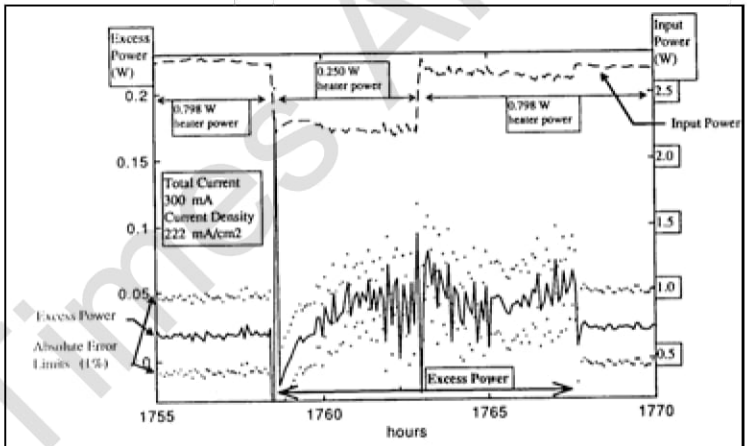


FIGURE 35. Fluctuating Excess Power Effects for the Same Johnson-Matthey Cathode as in Figure 34. The onset of excess power began shortly after the reduction in the heater power which changed the cell temperature.

End of Dr. Miles' Cold Fusion Report

momentum with space drives.

Marc G. Millis
NASA Lewis Research Center
Cleveland, Ohio

Thanks, Marc. More info. with which to update ***The Starflight Handbook****!—EFM*

• — • — •

Despite probable dead-end prospects for "hot fusion," I thought you'd like to see where some small part of our government's (our) money has gone in one Fusion R&D support effort since 1974. Too bad we cannot redirect all this enthusiastic expertise into the New Energy/Cold Fusion scene. At least, a number of people have had what they thought were good, worthwhile jobs.

I retired from the commercial division of McDonnell Douglas Corp. (MDC) in 1984. I watched with wonder as MDC was gobbled up in the big Boeing merger recently. Now the Boeing writer enthuses about BAC "coming up with the answer" to reproducing the sun's energy.... Do I hear chuckling in the background?

Willard Nelson
Olympia, Washington

Excerpt from the article by Dave Phillips in *Boeing News*, September 19, 1997:

"It has long been the dream of scientists to replicate on Earth the sun's process for producing energy. And it could just be The Boeing Company that one day comes up with the answer.

"A Boeing team in St. Louis has been recognized by the International Thermonuclear Experimental Reactor (ITER) project for developing technologies needed to demonstrate the feasibility of producing the sun's energy—fusion energy—on Earth.

"In an Aug. 14 ceremony at Boeing in St. Louis, Allen Atkins, vice president of Product Application Technologies in the Boeing Phantom Works division, accepted the ITER recognition award on behalf of the team from Charles Baker, ITER team leader for the United States.

"'In trying to recreate the energy of the stars, ITER is the way of the future,' Baker said. 'And the Boeing team has taken us a long way toward realizing this future.'"....For the ITER project, the Boeing team has been developing complex heat exchangers—called divertors—for use in the ITER reactor.

Thanks for the article on the "Phantom Works"—an appropriate name for ITER work! :) —EFM

New Energy Times Archive

The Death of a Very Good Man... Christopher P. Tinsley dies suddenly. –A Founder and Contributing Editor of *Infinite Energy*

On October 1, 1997, *Infinite Energy* Magazine and all the world suffered a great loss with the sudden, unexpected death of Contributing Editor Christopher P. Tinsley. He died at his home in Nottingham, UK, at age 54, from a massive heart attack.

Chris is survived by his two adult children, Kay Tinsley and Christopher John Tinsley, both of whom live in England. Also by his fianceé Susan Seddon ("Soo"), who has contributed greatly to *Infinite Energy*—and who will continue to do so. Chris is also survived by his sister and his mother (who is in her 90's, in very failing health, and not aware of this tragic event). Chris's wife Sian died several years ago after a long, incapacitating illness.

The funeral was held at St. Leonard's Church in Nottingham on October 9th. Following the ceremony, Chris's body was committed to a funeral crematorium—passing across the threshold to the sound of light-hearted, jolly music that he had once suggested for the occasion.

We dedicate this issue of *Infinite Energy* to the memory of Chris Tinsley. No words can adequately express the depth of sadness we experienced upon hearing of Chris's death. He will be sorely missed, but we shall carry on with renewed energy the monumental task he pursued.

Chris's C.V.—in his own words—may be found on page 122 of this issue.

We offer as a fitting memorial the following several pages of responses to Chris's untimely death.

Chris Tinsley, circa 1994 or earlier

Letter to Christopher P. Tinsley from Susan Seddon... Delivered by Chris's cousin Patrick Purves at the funeral ceremony, St. Leonard's Church, Nottingham, October 9, 1997

Darling Christopher,

I wish I was able to read this myself, but I know I wouldn't make it past this first sentence. I wish I had courage enough to stand before your family and friends here today, without being reduced to a blubbering wreck, and proudly declare, in my own words, the depth of our love for each other.

We were so ridiculously happy together, maybe it was just too good to last. I'm so grateful for the short time we did have though. I've never felt so wonderful or so much loved in my whole life.

Although we planned to marry as soon as we could, you used to say I was already your wife, we just didn't have the bit of paper.

That was how it felt to me too, like we were some old married couple. We couldn't bear to be apart for any length of time and you once joked that we'd end up with a tandem zimmerframe.

I thought we'd be together for ever. We had such marvellous plans for the future. We did, at least, manage a short holiday. You told me then that you had never been so happy in a very long time. That meant so much to me.

I have wonderful memories that I'll cherish for the rest of my life.

You were always good at digging up an appropriate quotation to suit any occasion and I remember you particularly liked one by D. H. Lawrence which was, **"The dead don't die, they look on and help."** If that's true, I hope you're looking on now and you can help me to face a bleak future without you.

You once said the whole point of existence was to leave the world a better place than you found it. You certainly succeeded in doing just that.

I miss you so much and I will love you for ever.

All my love
Your Susie

Eulogy for Christopher P. Tinsley Delivered by Eugene Mallove at the funeral ceremony at St. Leonard's Church, Nottingham, UK October 9, 1997

Though our dear, dearest brother, Christopher Tinsley, has passed beyond this earthly pale, and this grievously saddens us, he will remain an undying presence for those who carry on. Chris Tinsley gave so much to those who came to regard him as his soul brother—myself and Jed Rothwell—all these years since our joining together in 1991 in a Great Cause for Truth.... Truth about and justice for an outrageously maligned millennial discovery in science with deep roots in England and America.

As we did not in 1991, today we have full faith that this discovery of a source of infinite energy—clean, safe, and eternal—will before too many more moons give new life and hope to all the peoples of the world. Thanks to the absolutely indispensable work of Chris Tinsley, there are now many beacons of light penetrating the black night of ignorance and evil deceit.

New Energy Times Archive

Today, many thousands of human beings in three dozen countries have heard the voice of Chris Tinsley and have felt his deep humanity and extraordinary, magical wisdom. I have full faith that tomorrow, with the dawning of the New Day, millions of grateful souls will come to know him as one of the most genuine and important spirits of our time.

True enough, today the gentle goodness of Chris Tinsley—ineffable goodness—is celebrated only by this handful of gathered and the multitudes of those linked through cyberspace who hung on his every word, and from whom tributes continue to come. But each of us will carry some part of Chris Tinsley with us until our own ends of time.

We will all revere memories of Chris: His brilliant wit, his ability to cut to the chase, his role as creator, inventor, and peacemaker, his astonishing ability to do so much with such scant resources in all things electrical and mechanical. I will end with a beautiful statement in Chris's own words. I can hear him speaking them though they were committed to paper long ago:

"The idea of death troubles me not at all. Death is highly overrated, it is in fact no big deal. The problems are solely ones for those who have to handle the emotional and other problems which the person leaves behind. And I am not pretending that these problems are trivial ones. I commend each of you to the care of the others. Each of you carries something of me into the future. So love one another, you will not regret doing that."

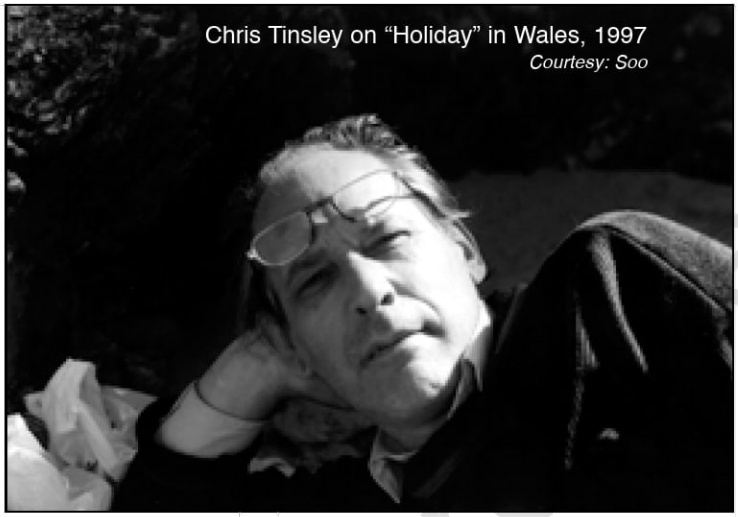
Dear Chris, wherever you may be flying, I am devastated that you are gone. I shall, we shall miss you greatly. I will miss sharing with you the wonders of the dawning New Age. But we will carry on as you would have wanted us to. God bless your great soul!

TRAVELS WITH TINSLEY.....
Chris Tinsley was my science tutor.
by Soo Seddon

He was quite appalled that I had dropped all school technical subjects at the tender age of 13, because some dysfunctional Physics Master chose to demonstrate Hooke's Law on my brassiere elastic.

He was, however, pleased that I also managed to drop a 5lb weight upon the foot of the said Physics Master, before retiring gracefully from his classroom. (I had, at least, grasped the basic laws of gravity).

So, Christopher took it upon himself to help me understand some fundamentals —and he did it with such style. He'd wax lyrical about his personal heroes— Faraday, Cavendish, and Thomson—usually in Indian restaurants. I have fond memories of his practical illustrations of great experiments, using available materials.


Chris Tinsley on "Holiday" in Wales, 1997
Courtesy: Soo

I know of no-one else who could reconstruct Cavendish's gravitational experiment using a pepperpot, some cutlery and two onion bhajis. Even the waiters paid attention.

And, of course, I had the privilege of touring around the country with him on his scientific sojourns for this magazine, as well as participating in many of the experiments he conducted towards furtherance of our noble cause.

My first field trip with him was a visit to interview Prof. Martin Fleischmann.....

We shared the driving of our old Volvo Estate down to Wiltshire. The skies are so clear and unpolluted by public lighting down there, and I recall being impressed by the naked eye clarity of the Orion Nebula, and told him so.

"Yes, darling," he said nervously. "But can you admire it when you're not driving down country lanes at 80 mph, please?"

He, of course, was the archetypical "expert" driver. You know, the one who has never been involved in an accident himself, but has witnessed countless numbers of them in his rear view mirror? I gave him the Native American name, "Stops-On-Traffic Islands" because, in a strange town, that's exactly what he would do. He'd get out a street map and be totally oblivious to the beepings and yellings of streams of irate motorists behind.

At the Fleischmann house he demonstrated his driving expertise. Sheila Fleischmann was temporarily wheelchair-bound and Christopher offered to move their car off the driveway in order that she could gain access to it.

He got into the car and she nervously asked me whether Chris had ever driven a car with automatic transmission before. My response was lost in the ensuing hail of gravel, most of which pebble-dashed poor Sheila and the front of their house.

"I don't think so," I said apologetically, picking small stones out of her hair.

We got nice interviews, with Martin and Sheila, and these were duly published in the magazine. [**Editor's Note**: If you haven't already, please *do* see Issue #11!]

On the way home, we stopped to absorb some culture at Stonehenge. Christopher was furious at the way it had been fenced off and at the ridiculous charges levied on those who wished to approach within 15 yards of the stones. He did, however, take consolation in his observation that lots of "damn foreigners" were being ripped off also.

Then we went to Avebury, where a middle-aged female, wearing bells and beads, attempted to engage him in conversation on the mystic significance of the area. Typically, he went into "Geordie-mode," saying: "Dunno, pet. Tha'ar aal a bunch o' stones to me, like."

Then there was the Ragland Cell to test.....

We had tremendous fun buying the equipment. He suspected that we were something of an enigma to the Nottinghamshire Chamber of Commerce. Local traders must have been totally baffled by our requirements.

What on earth, they must have speculated, does this couple want with all that plastic tubing and small electric pumps? We certainly didn't look like tropical fish breeders.

We tried to put on a good show when buying electronic components too, and his constant, cryptic, and loud references to my "personal" 3-phase electrical requirements did not go unnoticed in Radio Spares, I can tell you. He was irritatingly proud of the fact that he, alone, could make me blush in public.

Under his guidance, I became expert at cable-making and could eventually seal connections without his having to de-solder me from the bench.

In department stores, he'd loudly ask me to get batteries for the Geiger counter, then disappear, leaving some shop assistant looking at me funny. I'd apologetically explain that it was only being used to

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monitor the nuclear reactor we had in the garden shed.

I helped mostly with the plumbing on the Ragland cell. He was brilliant at just about everything but plumbing .... you should see the state of our bathroom!

I was generally the bimboid inspiration behind his flashes of genius—or so he said. When the electrical pumps kept overheating, I suggested that there must be a way of keeping them cool. Then he came up with the brilliant idea of using the overflow outlet—and he attributed this idea to me! He said I had a talent for stating the obvious, which was something he very often missed. I think it was intended as a compliment.

Then came the SMOT ....

Yet again, we baffled local manufacturers in our quest for materials. I told the puzzled boss of a local firm which manufactured ridiculously powerful NIB magnets - the first we tried—that I was getting annoyed that my instructions to the "old man" kept sliding off the fridge. He wasn't convinced. I carried a small stack of them out to the car in my coat pocket, and Christopher had a one-man "tug-of-war" to get me free from the metalwork. I felt I understood what it must be like to be Garfield.

Our lounge was filled with aluminum track, brass track, model railway track and we must have all but cornered the Midlands magnet market.

We'd spend hours designing link ramps and cutting them to shape. Chris was impressed at my rollaway from 1-mm above base level. Not what we sought, but we had fun with it anyway.

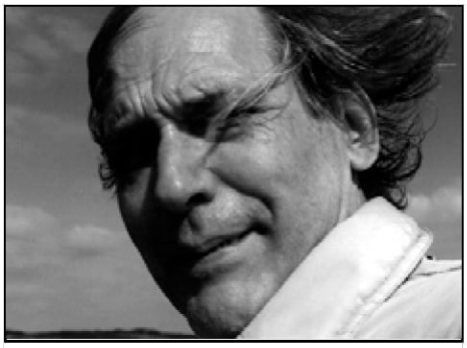
Then he did the Fortean Times UnConvention ....

I reported most of this (from my perspective) in the magazine and I'm still trying to get an audio transcript of his talk (hopefully for the next issue). It was very entertaining indeed.

Whilst in London, we visited the Science Museum to view Arthur Clarke's permanent exhibit and to see the Babbage Difference Engine. It was there we stumbled across an ancient KDF9 (an early version of the computer hard drive). He had worked on one many years ago which had gone to the National Physical Laboratory. He was ecstatic when I discovered a plate on the back of this device which identified it as having come from NPL. He swore he could make out his own teethmarks in the band caused by constant head crashes.

I was simply bemused at strolling around the Science Museum with a living fossil.

I didn't help much with the last experiment, the tile burning [Editor's Note: Related to the Cincinnati Group's inventions, see Issue #5&6.], apart from helping to carry huge boxes of tiles from various retailers. Although I did do the calorimetry on the flask and the tiles. I became quite proficient at taking thermal measurements.



Chris Tinsely, "Windblown in Wales"
Courtesy: Soo

We treated ourselves to a pair of matching welder's goggles though and considered nonchalantly watching TV whilst wearing them one evening when Chris Jr. and his girlfriend came round —just to see if they'd notice.

We had a terrific time "doing science". Maybe we never found all the answers, but I certainly learned a lot in the process.

I reckon my lecherous old Physics teacher, who is probably still demonstrating Hooke's Law on cherubs' harpstrings these days, ought to be proud of me, especially after Christopher has "had a word" with him.

++++++++++++++++

CONDOLENCES and PRAISE from Other Friends—Vortex Forum

I only knew Chris from his writing on Vortex and *Infinite Energy*—but even so his character as a great person came through. You were fortunate to know him as collaborator and friend.

His spirit will live beyond him, in the study of Nature's deep mysteries -- and curiosities!

Robert G. Flower

••••

I can only say to know of Chris Tinsley through Vortex, but this is most distressing news to hear. I came to look forward to Chris' input and viewpoints. His was a refreshing voice of reason and clarity. There will most definitely be a void. It is truly a great loss to all. My sincerest condolences to his colleagues, friends, and family.

John E. Steck
Prototype Tooling
Motorola Inc.

••••

Chris Tinsley represented what was the best in our quest for unravelling the mysteries of Nature. Always probing, not accepting anything at face value, and never losing a sense of humor generated by his real respect for where we stand in respect to all that Nature has yet to reveal. We will sorely miss his input, but attempt to follow the standard he set as a colleague's colleague. I salute you, Chris.

Dr.Hal Puthoff

••••

Damn! Damn! Damn! Why do the good ones have to go so early!? Chris visited us briefly a couple of years ago and the experience was truly memorable. We meshed like we'd been working together for years. He had a no-frills way of looking at physics and the business of measuring things that was simply beautiful.

Ad Astra, Chris. Please take with you the full measure of our respect and admiration.

Scott Little

••••

Goodbye, Chris.

Frank Stenger

••••

Having only lurked with an occasional private post, I never met or spoke with Chris. However, I've always enjoyed his posts and developed a respect for his opinions. I will miss his presence on Vortex. My sincere condolence to his family.

Tom Tamoria

••••

It's always a shock and disappointment when someone of Chris' caliber passes on. My sincerest condolences to the Tinsley family.

I attended Chris's Takahashi magnet motor talk three years ago at the Cold Fusion Conference (in Cambridge, Massachusetts). To have actually tested a working OU device made me realize that these advanced physics applications are possible here and now.

My only comfort in this situation is to know that the secrets of the universe are now laid before Chris for his enjoyment. Who knows, perhaps Chris is still in the position to give us a good elbow in the ribs when required to steer us true.

Anonymous

••••

Please tell the family that there were great many of us who knew Chris through his writings and that he will be missed.

Danny Hamilton

••••

I am so sad to hear it. You knew him better than me. What I could say is this is big loss for open minded society and for the vortex of course.

Hamdi Ucar

••••

I'm terribly shocked to hear about Chris.
I haven't spoken to him for a couple of months, but last time I did he sounded fine.

He will be greatly missed by his family and friends, not to mention the huge effort he put into the cause of honest science. I will certainly miss his great sense of humour and unstinting willingness to delve into his mine of classified information to answer some question.

I was trying to get him to be the first contributor to the Admiral Sir Anthony Griffin memorial lectures as he was probably the best informed person in the UK on the subject of "alternative energy."

The *IE* magazine will certainly lose a source of humour and reliable, readable copy.

Norman Horwood

••••

We enjoyed the topics Chris Tinsley brought to the attention of so many, ranging from over-unity devices to Martian landforms. Chris had a unique ability to both see through these subjects and present the issues with clarity and good, interesting writing. We already miss both him, and his prose, very much.

Dr. Mitchell Swartz
Cold Fusion Times

••••

Terrible news. Chris Tinsley was a great man. He will be missed by me and many others, no doubt.

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For those who believe in an afterlife, such as myself, I wish Chris well on the other side. And I wish him a good rebirth, when it finally happens.

Kurt Johmann

••••

I am saddened by the news of Chris Tinsley's sudden and unexpected death. I
greatly appreciated his sincerity and his commitment to learning, especially his commitment to learning by experiment.

Michael J. Schaffer
General Atomics

••••

I am so sorry I did not know Chris personally. This is probably a great experience I missed. Every time I hear someone's death, this reminds me that nothing is guarantied, and that I should enjoy my life today, and not tomorrow when things will become better.

All of us at Vortex we fight hard to understand the laws of nature, and get them accepted by the rest of the world. But in this endeavour a good sense of humor as Chris had is more than welcome.

Chris will not be here to send us new messages, but we will remember him.

Jean-Paul Biberian

••••

Chris' very dry sense of humor, and good sense, and his ability to defuse an emotionally charged argument will be sorely missed by this group. He had the ability to describe the essence of whatever was under discussion.

Hank Scudder

••••

It was a shock to read this sad news. I enjoyed reading Chris's messages to Vortex. He will be missed.

Ed Strojny

••••

I appreciate the true words about Chris many of you have posted. I find myself a little too perturbed by this just now to add much that's coherent. You know, I keep thinking - "He shouldn't have tried to quit smoking that damn pipe!" - that sort of thing.

And I feel so very bad for his family, and especially Soo.

This is a very cruel blow to many of us personally, and though a few of you out there might not fully appreciate it, it's a cruel blow to the whole larger purpose to which this list is dedicated. Chris could bring a wonderfully balanced perspective to even very emotional, confusing, and controversial issues with his trademark insight and dry wit in a way that I'm afraid no one will be able to replace. It's terrible to lose such a precious light in a field so desperately in need of illumination, and a
crushing loss to those who had the special honor of knowing him as a friend.

Gnorts, Chris.

Rick Monteverde
Honolulu, Hawaii

••••

My contacts with Chris were always interesting and enlightening. His works with my Associates in Russia were exemplary as to the way human beings should work together to resolve the problems that confront us all. He leaves us I fear, at a time when the world most needs people of his understanding and intelligence. This natural coarse of events that we must all endure is saddest when one is using their life in the search of knowledge that may be used to boost humanity to another level.

I will not say goodbye to you Chris, but instead "See you later."

dacha, dacha@visor.com

••••

Who cares about a drunken profligate, such as... [the latest high-profile accident death]!

But now we suffer a genuine loss!

I'm stunned. I don't know what to say!

Mark D. Hugo

••••

Chris Tinsley had a sharp, clever mind and wide eyed perception of things that are, and things that may be. I will miss his input and express my condolences to his family and close friends.

Ross Tessien

••••

Chris Tinsely, years ago, with children Chris John and Kay. Chris John is now in a Ph.D. program in neurosciences. Kay is a high-school teacher of English literature.

Rick Monteverde wrote, "This is a very cruel blow to many of us personally.."

Thanks Rick. I was having trouble expressing it but that's exactly howI feel. I've found it difficult to understand why I feel so pained and cheated at the premature loss of someone I knew only through his writings. I considered Chris a mentor. He re-introduced me to CF not by telling me it was real but by asking me why I was so sure it was dead. His spirit caused me to take up the sword against those who attack a thought without looking at the evidence. He came to my rescue when I got over my head on the Science Forum with -db- [Dick Blue]. He was a superior knight in the art of verbal jousting, taking down an opponent with scathing logic in such a manner that many never realized they were mortally wounded. He taught me to question everything and believe nothing but have faith in my knowledge.

Those who knew him personally must be suffering greatly. My heart goes out to his children and dear Soo and the remaining two Musketeers [Mallove and Rothwell]. But, I trust he now looks upon us with that knowing smirk and distinctly
British <sniff>.

"Gnorts, Chris."

Indeed. God bless you, Sir Tinsley. I am a better person for having known you.

Terry Blanton

••••

I just wanted to say how sorry I am. We have lost one of those rare people who can actually think clearly.

I am still undecided about whether anomalous energy sources exist. If Chris himself had found positive results or had discovered a "device," I would have bet my house on it, but his clarity of thought has left me with severe doubts about that of just about everyone else, including myself. I hope we are not fooling ourselves by proceeding on results from experimenters with feet of clay...

I have lost three significant people in my life this last week—Chris was probably the most influential.

Nick Palmer
Jersey Friends of the Earth

••••

Chris not wandering more, Chris not writing more his unique, clever, charming messages to us..I cannot believe this!

Chris not more traveling to interesting places, not more phoning me when cold fusion is victorious (like in the Power Gen demo's day) !? I cannot accept this, he was so young, so strong ("we British like to fight")—told he, so full of life.

I had the great privilege to meet with Chris when we went to Yuri Potapov [in Moldova] and we became good friends. He was (I wrote three times "is"!) a great man, intelligent, creative, knowing the secrets of past and future, with an immense treasure of universal culture in his mind. And, never forget this, he was a GOOD man. Very rare quality nowadays.

I remember I have seen tears in his eyes when he told me about the dreadfully unjust fate of his wife, about this terrible tragedy, the beloved person dying step by step because sodium ions replace potassium ions in her nervous cells...and medicine is powerless...Alas, Chris had a broken heart, but we hoped it is healing. Later, when he met an other wonderful, great lady I was convinced that Chris will have a long, good life and he will enjoy the victory of our cause, a victory which owes
him so much.

And said the Raven "Nevermore!" No, shut up ugly, black bird! Chris's soul, his inimitable spirit, the values of his life, his friends are alive. We will continue your work and will try to do it better, smarter! But we will so awfully miss you! My sincerest condolences to you Kay (I remember when we spoke at the phone during our travel with Daddy in Moldova), to you Chris Junior, to you dear Susan, so talented and admirable in your writings--special
thanks to you for making our friend's last days happy!

LA REVEDERE DRAGA CHRIS,
ODIHNESTE-TE IN PACE!

dr. Peter Gluck
Institute of Isotopic and Molecular Technology
Romania

••••

Like many others on Vortex, I was deeply saddened by the loss of Chris, even though I knew him mainly from his messages here. To search for a fitting tribute, I looked through my file of Vortex messages to find something in his own words.

In a message on December 4, 1996 he closed his message with the quote:

"History takes longer to live than it does in books."

And just last week he wrote:

"There is an unhealthy tendency toward 'tabloid science', with people wanting instant gratification, immediate resolution of questions. Life isn't like that, and neither is science."

It is a shame that history moved too slowly for Chris to see the results of his work widely accepted. Hopefully he has inspired others to have the patience to continue the work until the final chapter is written.

Bob Horst

••••

Well, rats!

I knew Chris since about 1990, on cserve. There's going to be a big empty place in the world now.

William Beaty

••••

Well, I just logged on after being away two days and saw the news about Chris. Like many others, I only knew him by his writings here. I just called up all the messages from him that are in my archives, and read through them. So much right-on logic, and to-the-point clarity; all suffused with his good-natured wit. I always looked forward to reading his posts. He has contributed much to our understanding, and his pres-

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ence will be sorely missed.

Dan Quickert

••••

Nowadays I spend my time more in lurking and enjoying the ups and downs of Vortex.

In past years, when I had a workshop, I was fairly active in building various "ou" models, none of which worked, but which gave Chris and me a great deal of fun and headaches. Chris was a realist and an honest scientist, and I grew to rely on his encyclopaedic recall of funny bits of knowledge about things and people. We were glad to see the end of his facial fungus (sorry Gene) [i.e. beard!]. He was a good model-maker as well as being a wiz in chemistry and computer science and his jokes were well worth repeating.

I will always be grateful to Jed for introducing me to Chris after I had heard Pons deliver his lecture with the video demo of the "boiling CF" electrolysis, and put out a query in the Sci-math forum of Compuserve. That was in '89 and things have moved on a bit since then.

I met his son Chris, Jnr. only once at their home, and have not met Kay or Soo, but I send them my heartfelt condolences and the hope that they will carry on in the tradition set by their tough dad - don't let the bastards grind you down.

Norman Horwood

••••

My most sincere condolences to the family.

Vince Cockeram
Las Vegas Nevada

••••

Finally got around to checking the internet and shocked to find the sad news about Chris Tinsley. Least expected of him to do this.

Please relay my sincere condolences to his family on your trip to the UK. Chris had wanted to get together to talk over the times when this cold fusion business was successfully overcome.

My brief acquaintance with him has been an education and enjoyable. The turn of a phrase, a different perspective, a very rational mind, an English approach to humour, the undying belief in cold fusion and having an open mind has been a full contribution to the Vortex conversation and the *Infinite Energy* effort. The loss is felt by everyone.

Thank you, Chris. Glad to have met you, online (and at Gene's Seminar). I am sure you know the answers now. Tell Gene & Jed. Till we meet 'there':

Akira Kawasaki

••••

Words from Chris Tinsley.....

The following is a sample post written by Chris Tinsley from last January 22, 1997 and is indicative of the positive quality and honesty of his thought processes. I thought I would re-post it for the benefit of new list arrivals:

"This post is pure prattle, and I apologise in advance for it. I'm just trying to get some kind of a handle on this 'new physics'. And I want very much to avoid the clever stuff, just to look at the basics.

"The idea is that we have no 'pull' forces, only 'push' forces. And 'particles' are themselves just manifestations of the 'vacuum energy'. We know that two ships parked close together in choppy seas will be pushed together by the fact that longer waves are excluded from the space between them, and the idea seems to be that this kind of action explains all the forces?

"And there is really only one push force? What we see as electrostatic attraction, or gravity, or that which overcomes inertia, are all really the same thing, and analogous to the two ships being pushed together. Magnetic forces are a variation on electrostatic force, seen when a charged mass moves. Mass is just the kinetic energy of the 'particles', which therefore interacts with the vacuum, and charge is something like having spin on the 'particle' — I know I'm misusing terms, but as I understand it mass is something like a 'static' form of energy, or a 'randomised' one, whereas

Sian Tinsely, many years ago, with one of the Tinsley children.

charge is something which has some kind of spin or vector with it? I'm pleased to leave the strong force out of all this for the moment, because I'd be happy with an atomic nucleus which behaves as it does. After all, since Thatcher scrapped that rather nice outfit in the UK which was working on nuclear structure, there doesn't seem to be a huge level of interest in that subject anyway. And just because when you zap a nucleus it produces bits, that doesn't (to me) mean that it contained those bits before it got zapped.

"The attribute of mass or charge interacts with the vacuum to produce a distortion in some quality it possesses, and thereby 'shields' another mass or charge from the push which otherwise would be symmetrical?

"The anisotropy of space, which appears to fit well the 'curvature' used to describe it in General Relativity, is just a localised distortion (by masses or charges) of its permeability/permittivity ratio?

"Now, I've never been thrilled with photons, because there seems to be a breach of the principle of parsimony here. We know matter reacts with em radiation in a quantised manner, but that doesn't seem to me to mean it has to travel in quantised form. And we have to have an infinite variety of photons, to allow for their infinite possible energies. But we then have the problem that light of wavelengths very much greater than the size of an atom will interact with that atom - or the other difficulties which the photoelectric effect and Compton scattering seem to present.

"But, hey, I've not seen a quantum treatment of long waves. Like, how do we fit antenna design into quantum theory? How do we count the em quanta coming into that antenna from a 1500m radio transmission? A dipole (leave alone one assisted by the director components of a UHF antenna) picks up much more energy than is incident upon it. Could an atom act as a dipole? Or could nearby atoms act as director sub-antennae?

"In the 'new physics', I suppose that em radiation must be a travelling distortion of the natural zp fluctuations. No real 'aether' as such, which was a virtually inelastic fluid, more some kind of bucket-chain with distortions being passed on. Yes, and it could be polarised and all the rest of it.

"One problem I have is that I don't see a proper description of all that in 'the new physics'. I can grasp dimly the notion that if a massive body were to pop from nowhere, its 'shielding' effect would propagate in all directions at c, but I'm less happy about the propagation of the similar effects of a changing charge - because that has to have some kind of vector or spin or something.

"Can someone tell me how the new physics explains how em propagates? And is this not a matter so fundamental that it should be addressed with some urgency by those who support these ideas? Maybe it has been, but I don't think I've seen an answer yet."

Chris Tinsley

While I did not personally know him, I enjoyed the high quality of his thinking and of his stimulating discussions.

My most sincere condolences to his family.

Evan Soule, josephnewman@earthlink.net

••••

I was deeply saddened today to learn of the death of my friend Chris Tinsley. I did not get to know Chris as well as I would have liked, and now I never will.

I first "met" Chris in conversations on the old Encounters forum on CompuServe, where we shared many interesting discussions and a great deal of humor. Then, when I was in London in October of 1995, if memory serves me, I got to meet Chris in person. We had planned to spend an afternoon and evening together, and Chris departed Nottingham in his Mini Cooper in a howling gale for the drive to London. Hours passed and I began to wonder what had become of him when he arrived at my hotel room at the Holiday Inn at Kings Cross dripping and a bit cross himself. He had had a flat tyre on the way, and had to change it in the driving rain.

We dried poor Chris off as well as we could and made our way to a cozy pub nearby where we dined and talked into the wee hours of the morning. I offered to let him camp out in my room until morning, but he insisted that would be an imposition and headed back to Nottingham.

That was the only time I saw him. We continued our e-mails, forum chat, and occasional telephone conversations, and hoped to meet up again. The last time I was in the UK we planned to get together, but something came up at the last minute and he couldn't come to London. So, I shall miss Chris greatly, as much for the time I spent with him, as for he time I had planned to spend with him in future.

This is, indeed, a great loss to us all.

Bob Shell

••••

I never dreamed this would be my first message to this group. Sometimes life is just not fair. I feel personally cheated this week of something I took for granted.

My heart goes out to Chris' family, and especially to Soo. He was a very special person, and he'll always have a place in my heart.

I want to say my goodbye to Chris here. Thanks for indulging me.

There is so much data in our world today, yet so little knowledge. Few people really have a handle on how complex and intriguing this little backwater blue planet is - but those that do change our lives forever.

Chris Tinsley was one of those people. I met Chris online about two years ago, and we've exchanged messages and ideas ever since. Chris had a unique way of looking at the world, and a very compelling way of expressing himself so that we could look at it in that way with him. I started my online life as a diehard scientific type, complete with paradigm paralysis.

If it was in a book, it had to be fact. Chris started me off gently, by examining logic itself. Then, before I knew it, he had me questioning gravity, then the entire scientific establishment. Chris showed me not only what to question, but how to question it.

I attempted to follow him through the maze of cold fusion, and we entered the field of gravity shielding together, even though he far bypassed me in a short time. I've never met anyone that could cut through a field of data and get to the bottom line like Chris could. I originally felt that Chris put on an act of humility - but it wasn't humility at all, nor was it an act. He merely realized how truly little he knew about how our world works, even though his knowledge was tremendous.

He was a master of clear thinking and was a teacher in the purest sense of the word, when he chose to be.

Meeting Chris this last April in London is an experience I shall never forget. Even though we'd traded messages for so long, we'd never met in person, yet he nodded to me as soon as I sat down to listen to his talk at the Fortean Times' Unconvention. With a short response to a simple question I posed, Chris managed

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to leave me totally speechless in front of a roomful of people. His quick wit and oh-so-British sense of humour always kept him two steps ahead of anyone else - except for Soo.

I have this feeling that Chris is somewhere right now chuckling at us making such a fuss over him, and laughing with glee as he finally finds the answers he's searched for so long. If he could, would he pass that knowledge on to us?

No. Chris knew that the journey is more important than the destination. He loved the quest for knowledge, and he shared that love with so many. This is his legacy.

Thank you, Chris, for opening my eyes to the infinite possibilities out there, and for helping me keep a dream alive when it was nearly extinguished. I haven't forgotten that you promised me a curry one of these days - you never know when I just might show up to collect it. I shall miss you. <sniff>

Debbie Hagar

••••

I am not ashamed to say I wept at the news of Chris' death, and weep again in reading the voices of my colleagues of Vortex praising him. I met him twice, once at Gene's forum where he described the Takahashi scooter, and later in Boston where I helped Gene, Jed and Chris with a presentation.

He enriched my life in ways I cannot count.

His posts were a window to the soul of great and brilliant man, of clear vision and deft wit. I treasured his incisive logic and support in private and public discourse. His flat-out dedication to this field is an example to us all. When he was ill a while back I wrote with concern that he care for himself, that I would miss him.

I do.

I will.

Mike Carrell

••••

Sincerest condolences to Chris Tinsley's family and friends. His words of wisdom will be missed here on earth. He now joins the great orators of the past "Upstairs". Till we meet 'there':

Peace on Earth,
Michael Randall

••••

Visiting a local temple today, the library at Los Alamos National Laboratory, I happily found a wonderful gift for Christopher Tinsley, who has plunged willingly into wider actuality-- for the transitions that we call birth and death are necessarily freely chosen on the level of soul, never accidental or imposed. Engrossed as we are with our daily work and play, like passengers shut in within a huge ocean liner, with its many levels, straight corridors, and myriad boxy rooms, suddenly we find his room empty, the open porthole cover perhaps left a little ajar, and through it we may glimpse in a moment of shocked awareness the ocean, vast to an illimitable horizon, deep, dynamic, free, unified, radiant, right here, already, always, that unseen sea which pliably, flexibly, and intimately supports the entire human world we know...a bright, natural light may spontaneously shine in to illuminate the daily dimness.

Since the dawn of cold fusion in 1989, the Chubbs have evolved what must be the correct theory, in the sense that Einstein's special and general relativity both are intrinsically, fundamentally right. Such theories point to the experiments that inevitably confirm them. Such theories open up vast new horizons. They throw a light that allows inquiry to be focused, and clearcut alternatives to be available. And such are beautiful....

Rich Murray
Room for All

••••

I received this message from Chris Tinsley's fiancee Susan Seddon. She requested that I post this to Vortex.

- Rick Monteverde
Honolulu, HI

"Gnorts,

I felt I had to place on record to all you Vortexians how much Chris's children and myself appreciate your kind messages of sympathy and support.

This is probably one of the saddest episodes in my life. I feel totally lost without him around making his quirky observations and spreading little pearls of wisdom. We used to laugh a lot (at the same time even !!!). I can well understand how much he'll be missed on Vortex - he was a message-poster par excellence.

One thing I know would have amused him no end is that his death has generated a conspiracy theory.....I can almost hear cackles of hysterical laughter from "Upstairs". He found the Princess Diana conspiracy speculations highly amusing and, even though he always remained open-minded on just about everything, I think he'd be quite bemused that anyone would consider him a sufficient threat to world order to justify a visit from The Men in Black.

I just wish he was around to post a suitable reply, in his own inimitable style, he would have really enjoyed doing that. Perhaps we should all keep a look-out for caustic comments posted via Heaven.com.

There has been a change to the arrangements for his funeral. It is still at St Leonard's Church, Wollaton but is now at 11.45am then 12.30 pm at Bramcote Crematorium. Anyone who wishes to attend will be very welcome.

I'd just like to thank you all again for your kind words, it has been very comforting to me to know that other people in the world also thought he was a wonderful, exceptional and totally irreplaceable man.

Love to you all,
Soo"

••••

Chris Tinsley was as much alive in my heart as anyone with whom I had ever shaken hands in person, although in truth, through what the ancients would have justly termed the 'miracle' of modern electronics, I knew him only via videotapes and many e-Mail correspondences. Of course, having seen him giving a scientific lecture and a technical demonstration of an experiment on videotape I knew what he looked and sounded like, but in his written messages his penetrating wisdom was even more apparent. I honestly believe that his wise advice may have tipped the balance between the Cincinnati Group (CG) faction wanting to hold their discoveries proprietary and those agreeing with the advice of Gene Mallove & Jed Rothwell to disclose *everything* for the benefit of mankind.

I am now listening to this uniquely humane spokesman & catalyst for progress as, for the last time, I read what he said to me on June 21: "Jed is of course exactly right. If the CG think that some Big Company will buy their process and build a plant, then they should realize that this just isn't going to happen. The reason is really quite simple, as Jed says; if you don't have a market (people who believe in your product) then you won't get any sales. ... Let me make one small effort to show the alternatives. CG can keep on with their efforts to sell their process to a slippery and disbelieving world with motorized goal posts. They can live on hope, which leaves their bellies empty and the world un-helped. Or they can let us help them, which will bring them solid money and 'make their other processes vastly more credible' when they want to sell those too. ... The choice is pretty stark and simple. It's a choice between a slice of an almost infinite cake, and the entirety of a cake of zero size. ... By the way, Gates doesn't have any patents. A patent is a license for others to steal your ideas, so the best thing is not to worry too much about that side of it all. Just set up your stall and sell into the open market. ... __Chris"

In the past few weeks Chris had been in direct contact with the CG regarding a process of theirs which they lacked time to pursue properly, and we regarded him as our point man spearheading the effort in that awesomely-important direction: limitless, free [overunity], excess energy!

My feeling that Chris was indispensable and irreplaceable is so strong that when I first heard of his tragically premature passing, my reaction to the dreadful loss was not the sympathy due his loved ones (to whom I have apologized) but such anger at Fate that I literally cursed our luck & cried: 'the Men in Black' have struck again!

After a little more time for composure, my reaction is that of a soldier in war who has lost a close comrade-in-arms who had been a major strength to all. How to carry on in the face of this staggering setback is not now apparent, but that is what our fallen comrade Chris would have wanted us to do.

Bob Bass

••••

Chris Tinsley's untimely death will make it harder for everyone to follow developments in CF. He was one of the few good reporters in the field. The *Three Musketeers of CF* (Mallove, Rothwell and Tinsley) have lost an experienced, knowledgeable, and intrepid comrade-in-arms.

Tinsley was a realistic experimenter as well as a good reporter. He knew that overunity devices didn't work, but that one could still learn something about the subtleties of physics by studying them. He also knew that CF was in a different league, and that a real energy-producing phenomenon had been discovered.

I always read and learned from Chris Tinsley's posts on SPF and Vortex-L as well as his articles in "Cold Fusion" and "Infinite Energy." I'll miss his contributions to the debate surrounding CF, and so will many other people.

It's a shame that he didn't live to see the first sustained public demonstrations of a CF device, i.e, demonstrations that would convince the media and the scientific community that there was a real energy-producing phenomenon worth covering and investigating. 1997 has already seen major progress toward that goal, and I think that he was looking forward to still more important developments in 1998.

I never had the privilege of meeting Chris, but I second John Steck and others on this forum in extending long-distance condolences to Chris Tinsley's family, friends, and colleagues.

Tom Stolper

••••

I too have only just downloaded my mail and got the sad news a little late. I give my condolences to his family and to Soo. If I can help with anything practical then please contact me (I am only in Doncaster) I will be happy do what I can.

Chris and I met on a couple of occasions when trying to get the Yusmar to work but spoke many times more on the phone and I guess like most of us, I wish I could have known him for much longer.

I enjoyed his posts and general approach to the subjects we discussed, he seemed to epitomise some of the better characteristics of what it means to be a true English gentleman. I shall look forward to renewing our acquaintance in the resurrection.

Mike Butcher

••••

Deepest condolences to the family and friends of Chris Tinsley for their great loss. Though I never met Chris in person, I feel a deep personal loss, and the loss of a potentially great good for humanity. I will miss his humor and modest good nature, his deep insight, his extensive knowledge of history combined with extraordinary open mindedness, and his kindly Socratic method. Chris possessed the special kind of deep intellectual honesty and personal integrity necessary to work successfully in such a difficult and shunned field of study as free energy. He taught me much about electromagnetism and motivated me to experiment. St. Vincent DeSola Pool said: "The learning of difficult subject material only occurs when an important reference person demands the effort." Chris was such an important reference person to me. Most of all I miss the chance to say good bye Chris, and thanks for so much so well done.

Horace Heffner

••••

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Only occasionally do I lurk Vortex these days as I work on my book which is rather far afield of the Vortex focus. Thus it is to my great dismay to hear of Chris's death. In correspondences with him in 1995 and 1996 on Vortex, I felt I had found a genuine electronic friend, a man you could count on to give his best with impeccable regard to human ethics and intellectual honesty. He taught me quite a bit about this form of communication and interaction. I had looked forward to meeting him in person someday in England.

Well, Chris, I hope you will have an even better vantage looking in from the outside.

Michael Wells Mandeville

••••

I was very sorry to read of Chris Tinsley's death. He helped me try to tell a little of the the truth about the vital subject of new energy technology. Our future has lost a good friend.

Dominic Murphy

••••

Having just downloaded 9 days of e-mail to find the news of the death of Chris Tinsley, I feel very sad and sympathetic toward those who survive him and loved him. I deeply admired the man and wish I had known him personally to tell him so, like so many others whose messages I have read.

As with Stephan Marinov, we must remember him in his devotion to our common desire for knowledge and progress.

By his delightful wit and intelligence, he will live on in our hearts and minds, at the very least.

Ed Wall

••••

I was very sad to hear of Chris Tinsley's sudden departure from this life. I thoroughly enjoyed his postings here which were full of wit, humour, intelligence and honesty. I learnt much from Chris through this forum, not least of which was to look closely at the many assumptions underpinning Science and my own set of beliefs. I wish that I had had the opportunity to meet him in person.

Martin Sevior

••••

This is a sad time,

I just read of the passing of Chris Tinsley.

I had the pleasure of talking with Chris, over the phone, once. His interest and encouragement in my SMOT work was of a great assistance when I was down. I was planning a trip to the UK early next year and presenting Chris with SMOT number 1. If I can locate Sue, its hers. Still can't believe I will not be able to do it in person.

Dear Chris, thanks for believing in me ..... Rest in Peace.

Life is too short. Money is not worth the paper its printed on!!!!!!!

I plan to fully disclose ALL my work (PMOD, RMOG, RMOD, SMOT) over the next few weeks.

Sorry Chris, I didn't do it sooner.

Greg Watson
Http://www.microtronics.com.au/~gwatson

••••

I was greatly saddened to learn of Chris's untimely death. He was instrumental in getting me to "take a chance on" Infinite Energy. The rest is history. He will be greatly missed .

The rest of us just have to suck it up and continue on. But for awhile, it won't be as much fun.

Jeffery D. Kooistra

Origins of the "Cold Fusion War" Traced to Nobel Laureate Glenn T. Seaborg's Advice to U.S. President George Bush.. on 4/14/89

(Continued from Page 3...)

The following extremely revealing account of Nobel laureate Glenn Seaborg's actions in the spring of 1989 appeared in a recent issue of the *Skeptical Inquirer,* November/December 1997, as part of "The Elemental Man: An Interview with Glenn T. Seaborg:

SI: During the early stages of the cold fusion furor, President Bush asked you to come to the White House and give him your views on the matter. What happened? What did you tell him?

SEABORG: In April 1989, I was called back to Washington to brief George Bush on "cold fusion," the totally unexpected phenomenon that University of Utah scientists announced they had discovered by the simple process of electrolysis of heavy water. A couple of days earlier, the purported co-discoverer of "cold fusion," University of Utah electrochemist Stanley Pons, spoke to an enthusiastic standing-room-only audience of chemists at the semi-annual meeting of the American Chemical Society in Dallas. His talk had attracted so much attention that, apparently, the news had reached the White House. After briefing White House Chief of Staff John Sununu, I went into the Oval Office to brief President Bush on April 14, 1989.

I told him about my role in the discovery of the radioactive iodine that had been used a couple of days earlier to treat his wife, Barbara, and said that a similar treatment with radioactive iodine had effected a miraculous cure for my mother, who was suffering from the same condition as Barbara. The president facetiously said that Barbara is now radioactive and she is not allowed to kiss their dog as long as this condition prevails, but he implied that it didn't seem that this prohibition included himself—the president.

I then went on and described briefly the situation with respect to cold fusion. <u>I indicated that this is not a valid observation—that is, that it is not due to nuclear fusion—but, on the other hand, it must be investigated.</u> The president seemed very interested and convinced by my assessment, and encouraged us very much to go ahead with an investigation. *[EFM's bolding and underline]*

I might add that the panel I recommended to study the purported "cold fusion" process was created and about six months later came out with a report disputing the validity of the observation, pretty much in line with the view I adopted in my briefing of the president. Also it is interesting to note that President Bush himself, two years later, in May 1991, benefitted from treatment with the same radioactive iodine (iodine-131).

••End of the SI Interview section••

Of course the panel that Seaborg recommended ended up with the negative view put forth by Seaborg on day one! How could it have done otherwise? Look at who was on the panel in leading roles. First we had Seaborg's close colleague, Prof. John Huizenga, then of the University of Rochester, the panel's driving force, who later wrote his version of cold fusion history [*Cold Fusion: The Scientific Fiasco of the Century,* 1992] In Huizenga's book, we find confirmation of Seaborg's negativity on April 14, 1989, but not until the *SI* Interview have we had such stark words from Seaborg himself.

Robert O. Hunter, Jr., a hot fusion man, was at the time the Director of DOE's Office of Energy Research. It was he who called upon Seaborg to come to Washington, according to Huizenga. On the morning of the 14th, Seaborg briefed Admiral Watkins, the DOE Secretary, and later John Sununu, Bush's top advisor.

By Huizenga's own statements, Huizenga was opposed to moves to have a cold fusion investigation. He wrote in his book: *"<u>My initial feeling was that the whole cold fusion episode would be short-lived and that it would be wise to delay appointing such a panel</u>. However, the persuasive manner of both Seaborg and Schoettler and the ongoing press reports on cold fusion convinced me that such a panel was necessary and timely from the Department of Energy's point of view for reasons to be discussed in the next chapter."*

Huizenga and Seaborg had already determined that the Utah results were unimportant, according to Huizenga in his book and elsewhere, because "...cold fusion should not be possible according to current nuclear theory, which is supported by a large body of experimental data."

But that was not the end of the bigotry on the DOE panel. We have this account by Gary Taubes (in *Bad Science,* 1993) from Dr. William Happer, a Princeton hot fusioneer: "Happer had decided upon hearing of cold fusion that it was probably wrong. In fact, a Scientific American reporter had called him a few days after the announcement, and Happer had

Continued on next page

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What Is Cold Fusion and Why Is It Important?

A Jazzy Radio Interview with Dr. Eugene F. Mallove

Radio Station WBCN, BOSTON SUNDAY REVIEW

Seaborg-Continued from previous page.

harangued him for over a hour on the various aspects of fusion—its physics, the fatal effects of neutrons—that made cold fusion so implausible. 'The thing I didn't have the nerve to do was say that just by looking at these guys on television, it was obvious that they were incompetent boobs.'" *[Editor's underline.—EFM]*

So much for the "impartiality" of the DOE cold fusion panel. And so much for the reputation of Glenn Seaborg, who helped initiate the disgraceful behavior of DOE these past nine years. He has done NOTHING to make amends. History will remember him for this. For now, his primary glory is having his name permanently affixed to element #106, seaborgium. *—Eugene Mallove*

BJ— Bradley Jay:

This is the Boston Sunday Review. I have Dr Eugene Mallove here and this is a very interesting topic and it could take a while, so... settle in. Dr Eugene is going to talk about cold fusion. What is cold fusion and why is it important?

EM—Eugene Mallove:

Cold fusion is extremely important because it is a new energy source which will transform the world. It will end the fossil fuel age. Basically, this discovery occurred in 1989. It was announced at the University of Utah and became extremely controversial. Lots of folks, particularly physicists and chemists in academe don't like it because they don't believe it. They feel somehow that the science that supports this spectacular new energy source from water is bogus. They are dead wrong.

BJ: We're used to fission, correct? That is what we deal with at nuclear power plants?

EM: Yes.

BJ: So there's fission, hot fusion, cold fusion.

EM: That is a good categorization.

BJ: Can you tell us about the categories and how they are different and where they are the same?

EM: Fission was discovered in the 1930's and led to the atomic bomb, which we dropped on Hiroshima and Nagasaki. We've had fission bombs since then and we've had fission nuclear power such as at Seabrook [powerplant] in New Hampshire, etc. Fission power is not in very good political order as you well know. Basically, it's the splitting of atoms that creates radioactivity.

BJ: It makes a mess.

EM: Makes a mess, yes. Even though I was a supporter of fission, but now we don't need fission, we don't need hot fusion— let me tell you what hot fusion is. Hot fusion is what goes into thermonuclear bombs, OK? Much more powerful than the atomic bomb. It also goes into these university reactors that are being researched at MIT and Princeton and elsewhere. They've been spending billions of dollars for many years— decades now— trying to get more energy out than in or to make the process work. It works like the Sun, the Sun is hot fusion and it produces deadly radiation. That's one thing they don't tell you about. It's not clean.

Now along came two chemists back in 1989, Pons and Fleischmann, and announced "Gee, you know we have this heavy water, which uses the same kind of heavy hydrogen the hot fusion people use for their experimental reactors but we can do it now, getting much more energy out than input and we don't get any deadly radiation."

BJ: Remind me to ask you what heavy water is in a moment. I want to back up — in fission, you split the atoms somehow and there is a by-product of this extreme amount of energy and then in fusion you somehow take atoms and fuse them together? How do you do that?

EM: The central parts of atoms, the nuclei, tiny little nuclei— the smallest part of the atom— are fused together and they are used in thermonuclear bombs, hydrogen bombs, and in the Sun. Hydrogen nuclei fuse together and release energy. OK, it's kind of the opposite of fission. Fission is done with heavy atoms, fusion is done with light nuclei, light atoms like hydrogen which is, of course, in all water.

Now along came these chemists, Pons and Fleischmann in 1989 and said, "We can do it in a test tube." We put energy in, electrical energy in, we don't create millions of degrees. We get so much energy out of this cell that we feel sure that we have (A) a real process and (B) it can't be chemistry, there's no chemical ashes that are visible and we see evidence of nuclear reactions. In my view and in the view of hundreds and thousands of scientists now around the world this process has now been confirmed.

BJ: When you say that it can't be chemistry, it's important that it's not chemistry. It seems kind of like chemistry, as you use the words "it's not chemistry" what do you mean?

EM: I mean it is much much more powerful than chemistry. Thousands and thousands of times more powerful.

BJ: Than a chemical reaction?

EM: Right. Chemical reactions are very weak. A small amount of material in chemistry will not heat your house, whereas in the case of a nuclear reactor: fission, hot fusion or, in this case, we're talking about cold fusion, it will do a lot. You will see this little cell, you will not see any significant evidence of waste material and yet you will get this spectacular heat. Now it is in the process of commercialization. Irrespective of whether the scientific community at large believes this, and it doesn't, it's being commercialized.

BJ: What is heavy water?

EM: Heavy water is in all water. One out of every 6,500 or so hydrogen atoms happens to be heavy. It's got an extra particle in its nucleus called a neutron and it makes it easier to fuse the heavy hydrogens together. The hot fusion people will work with heavy water.

BJ: Because that extra neutron fuses with that other atom's extra neutron?

EM: The various nuclear forces that make things stick together, work better when you have a neutron, that's the bottom line.

BJ: By the way, if anybody gets interested as a result of our talk, Dr. Mallove is the Editor-in-Chief of *Infinite Energy*, an entire magazine devoted to this topic. You talk of Drs. Pons and Fleischmann a lot, of course, because they invented this. How do people get hold of this?

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EM: We're up in Concord, New Hampshire and it's PO Box 2816, Concord, NH 03302.

BJ: Now, it totally works but it is not being accepted by the scientific community. It's being accepted by the commercial community because it works but, you say, not by the scientific community.

EM: Not exactly. The mainstream scientific community, that is those who became very outraged at the announcement of cold fusion in 1989. Such as folks at MIT, for example, former friends of mine who were in hot fusion. Those folks got very angry and they made all sorts of negative assaults against cold fusion; it's too bad they did because they missed the boat. There are many many physicists and chemists who became interested in cold fusion and who began working on it since 1989 in China, Russia, France, Italy, Japan in particular. And these people go to annual conferences that we have, international conferences. The last one was in Japan—there have been two major ones in Japan. The Japanese government has funded it and it is a worldwide activity. Commercial activity is going on now in the US and there are prototype commercial reactors that exist now.

BJ: How can the hot fusion people deny the existence of or, at least, the value of cold fusion?

EM: Oh, it's very simple to deny the existence of many things. The Wright Brothers, as an example, if you look back in history. They flew in 1903, in December, and it took five years, even though they were flying around in broad daylight, to convince *Scientific American* and mainstream academics that they were really flying. Well, we've had excess energy from water with no massive radiation since 1989, but the Department of Energy, MIT, Princeton, all have vested interests with their multi-million dollar hot fusion equipment, and they have vested interests in intellectual theories about how things can and cannot work—and they just won't believe us.

BJ: So you do the research and it's clear and you hold it up and they must see it but they have too much invested to agree.

EM: Yes. One of them said in a *Popular Science* article back in '93—he said: "Look, I suppose I'll believe it when you drive a car up from New Jersey." In other words, he won't look at the scientific evidence, which is massive and overwhelming, including by the way, some former hot fusion scientists like Professor Arata in Japan, who helped bring hot fusion to Japan. That man believes fully in cold fusion and has produced many excellent papers in the *Japanese Journal of Applied Physics* etc. that shows it works.

BJ: Why can't just as much money be made by cold fusion and therefore why aren't people embracing it?

EM: Well, lots of people are embracing it. It's not being written about much because you know how the story works....certain, quote, "important places" like MIT, Princeton and the Department of Energy, when they render an opinion that is negative about something, for some reason of human nature, other journalists, mainstream people such as the *New York Times* etc., tend to ignore it. They say, "The smart people found out that this is nonsense. So we will treat it as nonsense." Unfortunately, they are wrong. When I say unfortunately, I mean this is one of the greatest hopes for the world and I don't want to be millennial about this. But there is now on Earth, a new form of energy that, in my opinion, and in the opinion of many many people today—we have over 1,200 subscribers—many of these are highly competent, technical people who examine the field themselves. They feel this is real and they are very interested in developing it commercially.

BJ: So, this is as huge a thing as the government of the time not believing that the world was round?

EM: It's very very similar. Back in the days of Galileo, the Church Fathers had a preconceived notion about the Earth being the center of the universe, etc. They refused to look through the telescope. Much as today, the academic establishment, which does not believe in cold fusion, refuses to look at the evidence. In fact, a professor at MIT told me something which is the spitting image of what happened in the 1600's, he said: "I will not look at any more evidence for cold fusion, it's all junk!"—and he hung up the phone on me.

It was just like: "Don't tell me, don't disturb me with the facts, I know the facts!" He said, "I've had 50 years of experience in nuclear physics and I know what's possible and what's impossible." Later on, he went on national television, this was February 7, 1996, when a commercial cold fusion reactor was being discussed. He had no experience with it but he had no problem stating on national television, "I can tell you categorically there are no nuclear reactions occurring in this device." When there are, in fact. **[Editor's Note: The professor was physicist Hermann Feshbach.]**

Professor George Miley, who's a hot fusion person, one of the few in the United States who's had the courage to explore this, he himself has found nuclear changes—benign, safe— in cold fusion reactors.

BJ: So let's talk about the ways in which cold fusion is a better thing. It's cleaner and has less poisons.

EM: Zero.

BJ: Zero, none?

EM: Quite. Infinitely abundant fuel not confined to any particular country, so you can just cross off the oil-producing countries from now on.

BJ: The price of oil will go down?

EM: No, oil will still cost in the beginning. However, what will happen, in my opinion, is that when the first commercial cold fusion reactor comes out in a large way, as opposed to the small units that are beginning to be available now, overnight almost, oil stocks and those who invest in oil stocks will see tremendous losses in their portfolios.

BJ: A lot of the wars we see throughout the world are fuel-related wars, and once cold fusion becomes the things that everybody's got, there's no fighting over fuel.

EM: That's correct and the threat of global warming, all the issues, the scientific controversy of global warming which is a serious and important controversy, nonetheless revolves around *one* assumption. That assumption is that through the 21st century largely, we will be continuing to burn fossil fuel and the CO_2 is going to go up significantly. Now irrespective of whether one believes the threat or not, the fact of the matter is that if, as we believe, cold fusion energies are beginning to be used in the next several years in limited ways, that whole issue of massive combustion of fossil fuel which leads to CO_2 in the atmosphere, that's gone.

This should be one of the highest priorities in our federal research establishments, but unfortunately, fueled by nonsense that got started in 1989—basically propaganda against cold fusion—the Department of Energy wrote a negative report which was cast in concrete, so-to-speak, back then—and the public perception has been distorted by that horrible experience.

BJ: Is the President aware of this, any recent feedback from Congress?

EM: There are some Congressmen who have expressed intense interest in us, unfortunately, none of them have really done what has to be done, namely, revamping that outrageous report of the Department of Energy in 1989, getting rid of it basically and having another investigation. Basically, clean up the mess that was made in 1989. But frankly, we don't need the government. Private industry will take care of this. This is pre-eminently a

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private type of activity. However, it would be nice if we could have that report that was written back in 1989 questioned.

BJ: Let me picture how this works, whether you do it by describing the experiments, or by how a reactor would work in some sort of detail.

EM: There are two types of reactors that exist today. One I know more about, the other is a little behind closed doors at the moment. One is called the Clean Energy Technology cell—the first one to achieve a United States patent, by Dr. James Patterson. It has little beads in it that are coated with metals, special metals, and they don't need to be precious metals any longer. No longer the palladium of Pons and Fleischmann. They run a current through, a very small amount of power goes in.

BJ: Little beads, how big?

EM: Little beads, about 1 mm in size. And you have them in a little cell all encompassed together and there's an electrical connection, a negative electrical connection, and a positive. You feed a little bit of current through, water is flowing through.

BJ: So it's a cylinder, these beads are in a cylinder?

EM: The beads are in the cylinder. Several cubic centimeters of beads. In one test 40 cubic centimeters of beads were in this one test that we verified in California. This test had this electrolyte, or water, containing hydrogen, obviously flowing through. The amount of electricity that was passed through the beads was *minute*, only 1.4 watts going in, but what came out was more like 1,300 watts.

Now Motorola has tested cells just like that, not as big. They tested a Patterson cell like that and they had 20 watts coming out of one little cell and they turned the power off and it kept going for days. This is called "heat after death" and has been observed by many scientists in the field. So what you get out of cold fusion cells is beautiful, clean heat and none of the highly radioactive products that fission or hot fusion would give you and certainly no atmospheric pollution of the nature of fossil fuel combustion.

BJ: So what's going on inside the beads?

EM: Well if we knew for sure....

BJ: You don't really know?

EM: We have very good ideas about this, there are many battles over this. There are many different theories competing. In fact, there's one company I forgot to mention, it's the one I know less about, it's called HydroCatalysis in Pennsylvania, they now call themselves the BlackLight Power Corporation—whatever. They believe that this is a super-powerful type of quantum chemistry that does, indeed, also produce nuclear reactions. They believe that the hydrogen atom electrons, the electron around the hydrogen atom, can shrink, and they can extract energy out. They know of a process which works at very high temperatures and they extract the energy out of the hydrogen directly. There is no combustion with oxygen. So this is not fire, this is not burning, this has no relationship whatsoever to ordinary chemistry. It is a super-powerful process and they are going forward with commercialization.

BJ: So, you can examine the beads before you put them in, you know exactly the make-up of them. Now, after you take them out and they've gone through this process and you do that again, which I'm sure you must have done to try to figure out if they are different and therefore what happened. Well, how were they different and what happened?

EM: Very good question. They have been observed very carefully by Professor George Miley and others at the University of Illinois, Nuclear Engineering Department. They found heavy metals inside that had changed their identity. *Unthinkable* by conventional physics. This is transmutation of elements. You might say, you do not use the "A" word — alchemy. Is it possible that at low energy, low energy nuclear reactions can occur?

Physicists at MIT in the Physics Department will say, "Baloney—they will never occur. This cannot happen unless you are in an accelerator or unless you are in a hot fusion reactor—bombardment by neutrons." But these experiments show changes in metal. People in Japan have seen the same thing. People all over the world are beginning to see the same thing and slowly but inevitably a picture is being painted of this as a clean nuclear process, there may be other things involved such as the shrinkage of hydrogen atoms, maybe a multiplicity of processes. Very complicated, but nonetheless real and probably commercially viable before its explained.

BJ: You mentioned heavy metal, isn't that somehow bad?

EM: No. I mean steel is a heavy metal, nickel is a heavy metal, I don't mean like mercury or something of the sort. So it's a very clean process— that's the bottom line on it. Clean, abundant, wonderful ...

The movie coming out this week— "The Saint"—which I was Technical Adviser on, this is a 100% positive cold fusion movie. Cold fusion runs through the plot. It's about a professor, Elizabeth Shue by the way, who is involved with cold fusion, and what happens to her. There's also a movie that should be playing later this year, it was produced by Professor Keith Johnson, formerly of MIT, called "Breaking Symmetry" and it will be distributed, I understand, by Hollywood outlets.

BJ: Is this the kind of thing you can use for bombs if you wanted to?

EM: I don't think so. It is a new scientific discovery, no doubt about this. The implications of Fleischmann in our latest interview with him in the current issue of *Infinite Energy* magazine (issue #12), he does speculate about some of the potential hazards for weapon work. He doesn't go too far with that, but you never can tell. However, right now as we see it, the beautiful thing about cold fusion is this. It's clean, it releases energy slowly, so slowly that it's incredibly weak. The amount of energy coming out is far beyond the input. In some cases, as I mentioned, you turn the input off and it still stays hot. So we can find conditions that will allow it to go by itself. I hope we don't get into tinkering with it so much that we'll find ways to create fissionable materials or things of this sort, that would be a disaster but the facts are the facts.

There is one thing I would say, however, on the military side of things. Right now at our premier weapons laboratory, Los Alamos National Laboratory, there is a cold fusion scientist by the name of Tom Claytor and his group, and they are making through a cold fusion-like process—they are making radioactive tritium, which is a form of hydrogen that's radioactive. We have confirmed its production, and that is an ingredient that can be used in hydrogen bombs. Why our government isn't paying attention to this when its own laboratory is posting this data on the Web and we re-published it in the magazine is beyond me. It's scandalous, quite frankly.

BJ: I've been over to Los Alamos and it's a scary place. I could almost sense that the air was different. Is there a lot of radioactive stuff in those buildings?

EM: I'm not an expert on Los Alamos, but that brings to mind one other fascinating aspect of cold fusion that has just come up in the last two years. Since there are these unusual changes in the heavy elements that have been observed, there is now also a process discovered that uses cold fusion that remediates nuclear waste. Actually taking uranium and thorium—Clean Energy Technologies Corporation has done this—you put it in a device, they cooked it for just a few hours or a day and found substantial reduction in the radioactive counts.

Now this is *unthinkable*, absolutely unthinkable by modern physics. The ques-

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tion is, is the experiment correct or not? Now enough people have done this experiment and it has just now achieved patent status, by the way, such that I believe this part of it—that is, the remediation of radioactive waste to clean up the fission mess that we've created over the last 40 years—that, strangely enough is like the tail wagging the dog. Maybe the back door route to convincing DoE, negative people at MIT, etc., that this really is real. It's much easier to say, "Look, here's something radioactive now—24 hours later it's not radioactive. ou have not put it in an accelerator, you just put a little electricity in. Come on guys, let's get real! This is to be taken seriously!"

BJ: You mentioned MIT and the official stance at MIT...

EM: Well it's not something monolithic

BJ: But there must be some folks over there who are into this.

EM: Yes, there are. Professor Hagelstein at MIT is an exponent of cold fusion. He goes to all the conferences, he's a wonderful theorist. And, by the way, he nearly was denied tenure just because he was a theorist in that field. It's disgraceful and outrageous and I am embarrassed about my alma mater MIT for having created such a circumstance.

BJ: Back to a technical thing, we're back to the cylinder with the beads and there's water and there's changes taking place so we're looking at the beads, but what's the water look like after this process?

EM: The water is the same. It's marvellous. Now, when you have a cell it's so simple that it boggles the mind that modern physicists with all their sophistication, their high energy accelerators and so forth, cannot grasp this! Look, you have water flowing into a cell, call it a black box. It's at temperature 1 when it goes in and temperature 2 when it goes out, say 30 degrees Fahrenheit difference, as in the case of the Motorola test of the Clean Energy cell.

Now, you can calculate the flow rate of water, measure it, not calculate. You measure the flow rate of water, you measure the temperature difference and get a certain power, that power is 20 watts. No power is going into the cell. You watch this and record the data over time and you look at the water and you say "Well, are there any changes in the water? No, it's still got the same basic constituency. It doesn't look any different and yet we have a little thing here producing obviously 20 watts. What goes?"

Now you can do one of two things. You can deny it, you can say, "No, I can't accept this. Water cannot be flowing over little beads, or anything else, and be producing this heat without deadly radiation." The whole paradigm of modern physics states that if you want to have a circumstance like that you go to a fission reactor like at Seabrook where you do have a piece of metal inside the reactor that water flows through, and it gets very hot. It comes in at one temperature and goes out at another. It's just like that, except there's one problem, there's radiation, intense radiation. There's radioactivity produced. This produces *zippo* on that account.

BJ: Does this challenge the old rules that are held sacred, the old $E=mc^2$ and matter cannot be created nor destroyed?

EM: I don't believe so. I believe that Einstein's $E=mc^2$ is valid. Now there are two lines of thinking in cold fusion. One says: look, we will find all the reaction products, do the accounting—it's very complicated. We will add them all and we will find the change in mass, then $E=mc^2$ and voila! —that's the process. How this came about at all and why it is not producing deadly radiation is another matter, but $E=mc^2$ may be presumed.

Another line of thinking about cold fusion says: You know, it's even more wonderful than $E=mc^2$. There is something called *zero point energy* which pervades space. It's fluctuations in the quantum fields of space, and these fluctuations have produced forces on things and it is well regarded. But it is not well regarded that this energy from space could ever be extracted. Some people are beginning to think, like Dr. Hal Puthoff in Texas, he and others are beginning to think that maybe part of cold fusion and what's so mysterious about it is that at some very very small scale, below the size of nucleons in the nucleus, this quantum vacuum foam is interacting with matter and we are extracting some of that stupendous energy from space. Who knows. But it is a mystery which, as an engineer, not a theoretical physicist, as an engineer, I can tell you that the evidence for this phenomena is absolutely overwhelming, incontrovertible, and I am deeply sorry that our world, which so needs this process, not only for its energy supplies, a clean environment, end of global warming threats, has to be saddled by the—quite frankly—the academic corruption of those who prefer to make jokes about something that they don't understand.

BJ: With this process you are either getting something for nothing, or something from a place we don't understand yet?

EM: Perfect explanation, perfect categorization, that's exactly correct!

BJ: So it's probably not that you're getting something for nothing, from someplace else.

EM: We're not into violation of the conservation of energy. Much as we've been mocked for this: "Oh, they don't believe in the conservation of energy." We *do* believe in the conservation of energy-mass, but we are just saying we are doing experiments, getting effects that are incontrovertible, we need to find out how this really works.

BJ: Either we're getting something for nothing or something from somewhere we don't understand. If we're getting it from somewhere we don't understand, it might be this zero point energy? Then you are messing with the heavy things like three dimensions, aren't you getting into areas dealing with other dimensional stuff?

EM: Quantum fluctuations in the vacuum, these papers by the way that say this energy could be extracted, have been published in *Physical Review*, theoretical papers. Not, "This is how you extract the energy out," but they have been published, so it means that there is what MIT students would refer to as an *existence proof.* It is possible that it works.

BJ: If there is this stuff that we can get energy from that we haven't seen up to this time, doesn't that open up a whole set of questions about the beginnings of our universe, because it had to come from somewhere and this is a very powerful per pound thing. It sounds like you could make a universe out of this.

EM: Well, there are certain professors at MIT who have no problem at all holding seminars on creation of baby universes. This is par for the course, you can talk about that, you can't talk about cold fusion, but, let me tell you, if zero point energy comes to the fore the way it appears to be in recent experiments at the University of Washington done by someone who is now at Los Alamos—proved once and for all—yes it's there, it's manifesting a force called the Casimir force, it's possible others say that we could extract this. Now if this energy is there, extractable and influencing our universe, so to speak, it's part of our universe and can be something to be reckoned with, then it means that many other phenomena that have been mysterious might partake of that also. It might be explainable.

I'm talking about things that are very heretical, I'm sure you can use your imagination. Anything that would involve influences through space and appear to be mysterious.

BJ: Give me a scenario about how zero point energy might somehow influence

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universal creation.

EM: Our universe itself is said to be something like a free lunch. There is a pre-existing something.

BJ: The whole problem is where did it all come from?

EM: Well, before space and time, whatever that means, I don't know what that means, but, quote, "before space and time" there was some kind of manifold, I can't visualize this, but just for the sake of argument, some fluctuation occurred in that manifold and—voila! We have the present universe. which grew from an infinitesimal region supposedly and is, in fact, that free lunch.

The whole universe in some sense by modern physical thinking with the Big Bang and so forth is a free lunch. Now you come *into* our universe and nobody wants to talk about a free lunch and I don't either. I don't want to say that this energy that we're seeing in cold fusion experiments came from nowhere. As you rightly point out, it comes from *someplace,* and, frankly, I don't care where it comes from. I mean I do in a scientific sense, I'm fascinated by it and the sooner we know what it is the better, but we can use it now as technologists. I mean I believe firmly that it will be used to heat homes, to end the fossil fuel age before we fully understand how it works. We don't need that understanding.

BJ: Do you think you may, down the road, run into problems with the Church?

EM: The Church of Science.

BJ: Well, you know it's got to come from somewhere, we see all the stuff in the universe, it must have come from somewhere. There is no free lunch, therefore God had to make it. Are you coming up with not maybe a free lunch but a third alternative that might make God unnecessary for explaining the beginning of the universe you're in trouble.

EM: Well, we're getting off the field right here, but you know I do believe that since this discovery occurred in 1989, occurred 12 hours before the Exxon Valdez ran aground—which was pure poetry. The fact that it is occurring near the year 2000 is probably going to make a lot of people have millennial thinking like, "Oh my God the end of the world as we formerly knew it". Maybe that's an over-simplification, maybe the Mormons in Utah will claim it for their own. Maybe the Catholic Church or other churches will say "This is wonderful, energy from water what could be better! We knew water was holy, we knew water was part of all life, now we see that a miracle has been in existence for aeons, we just didn't know it. We were swimming in it, we were drinking it, we were part and parcel of this mysterious fluid called water and yet for some reason the secret of getting the energy out of it defeated us for centuries."

BJ: You have this magazine and I notice you have actually have diagrammed out the experiment, the Patterson cell, all we've roughly been talking about. It's for everybody.

EM: It's for not only technical people but lay people can understand it. There's a smorgasbord of materials there. You know, I used to be the Chief Science Writer of MIT's News Office, I was experienced in writing for the general public. We try to make it accessible. It's published six times a year.

BJ: There is a picture here of a microsphere. That's not one of the beads, is it?

EM: Yes.

BJ: You have a picture of the beads, before and after.

EM: And more to the point in that very issue, Professor George Miley of the University of Illinois at Urbana who is the Editor of *Fusion Technology*, that's a hot fusion magazine, he's a good man. He is putting forth his assessment of what he has seen in those beads, before and after. This is no joke. This is a man who has put his credibility on the line. There are other professors by the way, such as Quentin Bowles in the mid-west and other individuals who have made these measurements on the Patterson cell, as one example of a cold fusion cell, and they find them to be without question heat-producers. Heat is the important thing in cold fusion.

BJ: *The Saint* movie...how much do you learn about the process in the movie? Anything at all?

EM: I'll tell what you learn if they stay true to the script that they started with. I came in to review the script and gave them a few suggestions. You will find cold fusion treated properly, that is it is respected, it's not considered nonsense and they refer back to the original Pons and Fleischmann discovery and they say, "You know if *Nature* magazine had not given them so much difficulty in those early days, we could have had more funding and so forth." This is proper reference I would say. It's not a technical movie to explain cold fusion, but it gives hope and it brings the issue to the fore.

BJ: So it's a secret agent movie?

EM: Yes.

BJ: Is it like the secret of cold fusion, where we have to have the secret before the bad guys?

EM: Guys in Russia are stealing the secret of cold fusion, and Val Kilmer who is a kind of dual figure, he has a positive and negative side, he's out there stealing it, then he's sorry he stole it, double crossed etc. But generally a very exciting movie with a triumphal end. Cold fusion is triumphant in this movie.

BJ: If the weapons potential here is only marginal, why not just give it to the Russians or whoever?

EM: There's a lot of work going on in cold fusion in Russia.

BJ: Why not just give it to them, so they have the energy and everybody is happy?

EM: This process is so simple ultimately, I am convinced, that much as other countries like China and India perhaps and other countries have in some sense taken some of our patented technology and used them like they take CD's, I suspect that it would be very hard in the future beyond the confines of Western Europe and the US to control the patent situation. I think this will be used much as solar power is used, except this is infinitely better than solar power.

Solar power depends on the rotation of the Earth, if the weather is bad, it's very weak, you have to have big collectors. Wind power is no good. It's obviously good for certain applications, but can you imagine the difference between a source that is compact, doesn't require large structures, doesn't require any place where there are basic wind forces, you know blowing all the time like mountains, and you can put it in cars, you can put it in homes etc?

BJ: Easily, can you put it in a car easily?

EM: We're at around the stage of the transistor around 1950, which obviously has revolutionized the world, into computers and communication and everything else. I think this revolution will go faster than the transistor revolution and the computer revolution once people begin to fully grasp what's going on here and when commercial interests get hold of it.

The transistor in 1950, no one would have dreamed that 40 years later we would have massive computing power on everyone's desk. In fact, in the hands of little kids who are playing computer games. They have more computer power than anyone on Earth had in 1950. Well today, we're in that position with cold fusion. It's weak, it's a novelty, it's much disparaged, no one seems...I mean the powers that be...don't seem to be respecting it, but nevertheless it can change the world.

The Wright Brothers changed the world even though five years after they flew they were still being denied.

BJ: Dr. Mallove, thank you!

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CAN THE VACUUM BE ENGINEERED FOR SPACEFLIGHT APPLICATIONS? OVERVIEW OF THEORY AND EXPERIMENTS

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ABSTRACT

Quantum theory predicts, and experiments verify, that empty space (the vacuum) contains an enormous residual background energy known as zero-point energy (ZPE). Originally thought to be of significance only for such esoteric concerns as small perturbations to atomic emission processes, it is now known to play a role in large-scale phenomena of interest to technologists as well, such as the inhibition of spontaneous emission, the generation of short-range attractive forces (e.g., the Casimir force), and the possibility of accounting for sonoluminescence phenomena. ZPE topics of interest for spaceflight applications range from fundamental issues (where does inertia come from, can it be controlled?), through laboratory attempts to extract useful energy from vacuum fluctuations (can the ZPE be "mined" for practical use?), to scientifically-grounded extrapolations concerning "engineering the vacuum" (is "warp-drive" space propulsion a scientific possibility?). Recent advances in research into the physics of the underlying ZPE indicate the possibility of potential application in all these areas of interest.

INTRODUCTION

The concept "engineering the vacuum" was first introduced by Nobel Laureate T. D. Lee in his book *Particle Physics and introduction to Field Theory*. As stated there: "The experimental method to alter the properties of the vacuum may be called vacuum engineering.... If indeed we are able to alter the vacuum, then we may encounter some new phenomena, totally unexpected." Recent experiments have indeed shown this to be the case.

With regard to space propulsion, the question of engineering the vacuum can be put succinctly: "Can empty space itself provide the solution?" Surprisingly enough, there are hints that potential help may in fact emerge quite literally out of the vacuum of so-called "empty space." Quantum theory tells us that empty space is not truly empty, but rather is the seat of myriad energetic quantum processes that could have profound implications for future space travel. To understand these implications it will serve us to review briefly the historical development of the scientific view of what constitutes empty space.

At the time of the Greek philosophers, Democritus argued that empty space was truly a void, otherwise there would not be room for the motion of atoms. Aristotle, on the other hand, argued equally forcefully that what appeared to be empty space was in fact a plenum (a background filled with substance), for did not heat and light travel from place to place as if carried by some kind of medium?

The argument went back and forth through the centuries until finally codified by Maxwell's theory of the luminiferous ether, a plenum that carried electromagnetic waves, including light, much as water carries waves across its surface. Attempts to measure the properties of this ether, or to measure the Earth's velocity through the ether (as in the Michelson-Morley experiment), however, met with failure. With the rise of special relativity which did not require reference to such an underlying substrate, Einstein in 1905 effectively banished the ether in favor of the concept that empty space constitutes a true void. Ten years later, however, Einstein's own development of the general theory of relativity with its concept of curved space and distorted geometry forced him to reverse his stand and opt for a richly-endowed plenum, under the new label *spacetime metric*.

It was the advent of modern quantum theory, however, that established the quantum vacuum, so-called empty space, as a very active place, with particles arising and disappearing, a virtual plasma, and fields continuously fluctuating about their zero baseline values. The energy associated with such processes is called zero-point energy (ZPE), reflecting the fact that such activity remains even at absolute zero.

THE VACUUM AS A POTENTIAL ENERGY SOURCE

At its most fundamental level, we now recognize that the quantum vacuum is an enormous reservoir of untapped energy, with energy densities conservatively estimated by Feynman and others to be on the order of nuclear energy densities or greater. Therefore, the question is, can the ZPE be "mined" for practical use? If so, it would constitute a virtually ubiquitous energy supply, a veritable "Holy Grail" " energy source for space propulsion.

As utopian as such a possibility may seem, physicist Robert Forward at Hughes Research Laboratories demonstrated proof-of-principle in a paper published in 1984, "Extracting Electrical Energy from the Vacuum by Cohesion of Charged Foliated Conductors." Forward's approach exploited a phenomenon called the *Casimir Effect*, an attractive quantum force between closely-spaced metal plates, named for its discoverer, H. G. B. Casimir of Philips Laboratories in the Netherlands. The Casimir force, recently measured with high accuracy by S. K. T Lamoreaux at the University of Washington, derives from partial shielding of the interior region of the plates from the background zero-point fluctuations of the vacuum electromagnetic field. As shown by Los Alamos theorist Milonni and his colleagues, this shielding results in the plates being pushed together by the unbalanced ZPE radiation pressures. The result is a corollary conversion of vacuum energy to some other form such as heat. Proof that such a process violates neither energy nor thermodynamic constraints can be found in a paper by D. Cole and myself published in 1993 under the tide "Extracting Energy and Heat from the Vacuum."

Attempts to harness the Casimir and related effects for vacuum energy conversion are ongoing in our laboratory and elsewhere. The fact that its potential application to space propulsion has not gone unnoticed by the Air Force can be seen in

its request for proposals for the FY-1986 Defense SBIR Program. Under entry *AF86-77, Air Force Rocket Propulsion Laboratory (AFRPL) Topic: Non-Conventional Propulsion Concepts* we find the statement: "Bold, new non-conventional propulsion concepts are solicited.... The specific areas in which AFRPL is interested include.... (6) Esoteric energy sources for propulsion including the zero point quantum dynamic energy of vacuum space."

Several experimental formats for tapping the ZPE for practical use are under investigation in our laboratory. An early one of interest is based on the idea of a Casimir pinch effect in non-neutral plasmas, basically a plasma equivalent of Forward's electromechanical charged-plate collapse (see Puthoff, 1990). The underlying physics is described in a paper submitted for publication by myself and M. Piestrup, and it is illustrative that the first of several patents issued to a consultant to our laboratory, K. R. Shoulders, contains the descriptive phrase "... energy is provided... and the ultimate source of this energy appears to be the zero-point radiation of the vacuum continuum."

Another intriguing possibility is provided by the phenomenon of sonoluminescence, bubble collapse in an ultrasonically-driven fluid which is accompanied by intense, sub-nanosecond light radiation. Although the jury is still out as to the mechanism of light generation, Nobelist Julian Schwinger has argued for a Casimir interpretation. Possibly related experimental evidence for excess heat generation in ultrasonically driven cavitation in heavy water is claimed in an EPRI Report by George and Stringham of E-Quest Sciences, although attributed to a nuclear micro-fusion process. Work is under way in our laboratory to see if this claim can be replicated.

Yet another proposal for ZPE extraction is described in a patent issued to Mead and Nachamkin [Editor's Note: See full patent reproduced in *Infinite Energy*, Issue #11, pp.29-34.]. The approach proposes the use of resonant dielectric spheres, slightly detuned from each other, to provide a beat-frequency downshift of the more energetic high-frequency components of the ZPE to a more easily captured form. We are discussing the possibility of a collaborative effort between us to determine whether such an approach is feasible.

Finally, an approach utilizing micro-cavity techniques to perturb the ground state stability of atomic hydrogen is under consideration in our lab. It is based on a 1987 paper of mine in which I put forth the hypothesis that the nonradiative nature of the ground state is due to a dynamic equilibrium in which radiation emitted due to accelerated electron ground state motion is compensated by absorption from the ZPE. If this hypothesis is true, there exists the potential for energy generation by the application of the techniques of so-called *cavity quantum electrodynamics QED*. In cavity QED, excited atoms arc passed through Casimir-like cavities whose structure suppresses electromagnetic cavity modes at the transition frequency between the atom's excited and ground states. The result is that the so-called "spontaneous" emission time is lengthened considerably (for example, by factors of ten), simply because spontaneous emission is not so spontaneous after all, but rather is driven by vacuum fluctuations. Eliminate the modes, and you eliminate the zero-point fluctuations of the modes, hence suppressing decay of the excited state. As stated in an April 1993 *Scientific American* review article on cavity QED, "An excited atom that would ordinarily emit a low-frequency photon cannot do so, because there are no vacuum fluctuations to stimulate its emission...." In its application to energy generation, mode suppression would be used to perturb the hypothesized dynamic ground-state absorption/emission balance to lead to energy release (patent pending).

An example in which Nature herself may have taken advantage of energetic vacuum effects is discussed in a model published by ZPE colleagues A. Rueda of California State University at Long Beach, B. Haisch of Lockheed-Martin, and D. Cole of IBM. In a paper published in the *Astrophysical Journal* in 1995, they propose that the vast reaches of outer space constitute an ideal environment for ZPE acceleration of nuclei and thus provide a mechanism for "powering up" cosmic rays. Details of the model would appear to account for other observed phenomena as well, such as the formation of cosmic voids. This raises the possibility of utilizing a "sub-cosmic-ray" approach to accelerate protons in a cryogenically-cooled, collision-free vacuum trap and thus extract energy from the vacuum fluctuations by this mechanism.

THE VACUUM AS THE SOURCE OF GRAVITY AND INERTIA

What of the fundamental forces of gravity and inertia that we seek to overcome in space travel? We have phenomenological theories that describe their effects (Newton's Laws and their relativistic generalizations), but what of their origins?

The first hint that these phenomena might themselves be traceable to roots in the underlying fluctuations of the vacuum came in a 1967 study published by the well-known Russian physicist Andrei Sakharov. Searching to derive Einstein's phenomenological equations for general relativity from a more fundamental set of assumptions, Sakharov came to the conclusion that the entire panoply of general relativistic phenomena could be seen as induced effects brought about by changes in the quantum-fluctuation energy of the vacuum due to the presence of matter. In this view the attractive gravitational force is more akin to the induced Casimir force discussed above, than to the fundamental inverse square law force between charged particles with which it is often compared. Although speculative when first introduced by Sakharov, this hypothesis has led to a rich and ongoing literature (including a contribution of my own in 1989) on quantum-fluctuation-induced gravity, a literature that continues to yield deep insight into the role played by vacuum forces.

Given an apparent deep connection between gravity and the zero-point fluctuations of the vacuum, a similar connection must exist between these self-same vacuum fluctuations and inertia. This is because it is an empirical fact that the gravitational and inertial masses have the same value, even though the underlying phenomena are quite disparate. Why, for example, should a measure of the resistance of a body to being accelerated, even if far from any gravitational field, have the same value that is associated with the gravitational attraction between bodies? Indeed, if one is determined by vacuum fluctuations, so must the other.

To get to the heart of inertia, consider a specific example in which you are standing on a train in the station. As the train leaves the platform with a jolt, you could be thrown to the floor. What is this force that knocks you down, seemingly coming out of nowhere? This phenomenon, which we conveniently label inertia and go on about our physics, is a subtle feature of the universe that has perplexed generations of physicists from Newton to Einstein. Since in this example the sudden disquieting imbalance results from acceleration "relative to the fixed stars," in its most provocative form one could say that it was the "stars" that delivered the punch. This key feature was emphasized by the Austrian philosopher of science Ernst Mach, and is now known as Mach's Principle. Nonetheless, the mechanism by which the stars might do this deed has eluded convincing explication.

Addressing this issue in a 1994 paper entitled "Inertia as a Zero-Point Field Lorentz Force," Haisch, Rueda and I were successful in tracing the problem of inertia and its connection to Mach's Principle to

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the ZPE properties of the vacuum. In a sentence, although a uniformly moving body does not experience a drag force from the (Lorentz-invariant) vacuum fluctuations, an *accelerated* body meets a resistance (force) proportional to the acceleration. By *accelerated* we mean, of course, accelerated relative to the fixed stars. It turns out that an argument can be made that the quantum fluctuations of distant matter structure the local vacuum-fluctuation frame of reference(see Puthoff, "Source...," 1989). Thus, in the example of the train the punch was delivered by the wall of vacuum fluctuations acting as a proxy for the fixed stars through which one attempted to accelerate.

The implication for space travel is this: *Given the evidence generated in the field of cavity QED (discussed above), there is experimental evidence that vacuum fluctuations can be altered by technological means. This leads to the corollary that, in principle, gravitational and inertial masses can also be altered.*

The possibility of altering mass with a view to easing the energy burden of future spaceships has been seriously considered by the Advanced Concepts Office of the Propulsion Directorate of the Phillips Laboratory at Edwards Air Force Base. Gravity researcher Robert Forward accepted an assignment to review this concept. His deliverable product was to recommend a broad, multi-pronged effort involving laboratories from around the world to investigate the inertia model experimentally.

After a one-year investigation Forward finished his study and submitted his report to the Air Force, who published it under the title *Mass Modification Experiment Definition Study* [Editor's Note: Forward's study was reproduced in it entirety in *Infinite Energy*, Issue #9, pp.53-64]. The Abstract reads in part:

> ".... Many researchers see the vacuum as a central ingredient of 21st-Century physics. Some even believe the vacuum may be harnessed to provide a limitless supply of energy. This report summarizes an attempt to find an experiment that would test the Haisch, Rueda and Puthoff (HRP) conjecture that the mass and inertia of a body are induced effects brought about by changes in the quantum-fluctuation energy of the vacuum.... It was possible to find an experiment that might be able to prove or disprove that the inertial mass of a body can be altered by making changes in the vacuum surrounding the body."

With regard to action items, Forward in fact recommends a ranked list of not one but four experiments to be carried out to address the ZPF-inertia concept and its broad implications. The recommendations included investigation of the proposed "sub-cosmic-ray energy device" mentioned earlier, and the investigation of an hypothesized "inertia-wind" effect proposed by our laboratory and possibly detected in early experimental work by Forward and Miller, though the latter possibility is highly speculative at this point.

ENGINEERING THE VACUUM FOR "WARP DRIVE"

Perhaps one of the most speculative, but nonetheless scientifically-grounded, proposals of all is the so called Alcubierre Warp Drive. Taking on the challenge of determining whether Warp Drive *a la* Star Trek was a scientific possibility, general relativity theorist Miguel Alcubierre of the University of Wales set himself the task of determining whether faster-than-light travel was possible within the constraints of standard theory. Although such clearly could not be the case in the flat space of special relativity, general relativity permits consideration of altered spacetime metrics where such a possibility is not *a priori* ruled out. Alcubierre's further self-imposed constraints on an acceptable solution included the requirements that no net time distortion should occur (breakfast on Earth, lunch on Alpha Centauri, and home for dinner with your wife and children, not your great-great-great grandchildren), and that the occupants of the spaceship were not to be flattened against the bulkhead by unconscionable accelerations.

A solution meeting all of the above requirements was found and published by Alcubierre in *Classical and Quantum Gravity* in 1994. The solution discovered by Alcubierre involved the creation of a local distortion of spacetime such that spacetime is expanded behind the spaceship, contracted ahead of it, and yields a hypersurfer-like motion faster than the speed of light as seen by observers outside the disturbed region. In essence, on the outgoing leg of its journey the spaceship is pushed away from Earth and pulled towards its distant destination by the engineered local expansion of spacetime itself. (For follow-up on the broader aspects of "metric engineering" concepts, one can refer to a paper published by myself in *Physics Essays* in 1996.) Interestingly enough, the engineering requirements rely on the generation of macroscopic, negative energy-density, Casimir-like states in the quantum vacuum of the type discussed earlier. Unfortunately, meeting such requirements is beyond technological reach without some unforeseen breakthrough, as emphasized by Pfenning and Ford in a recently submitted manuscript.

Related, of course, is the knowledge that general relativity permits the possibility of *wormholes*, topological tunnels which in principle could connect distant parts of the universe, a "cosmic subway" so to speak. Publishing in the *American Journal of Physics* in 1988, theorists Morris and Thorne initially outlined in some detail the requirements for traversable wormholes and have found that, in principle, the possibility exists provided one has access to Casimir-like, negative-energy-density quantum vacuum states. This has led to a rich literature, summarized recently in a 1996 book by Matt Visser of Washington University, St. Louis. Again, the technological requirements appear out of reach for the foreseeable future, perhaps awaiting new techniques for cohering the ZPE vacuum fluctuations in order to meet the energy-density requirements.

CONCLUSIONS

We began this discussion with the question: "Can the vacuum be engineered for spaceflight applications?" The answer is: "In principle, yes." However, engineering-wise it is clear that there is a long way to go. Given the cliche "a journey of 1000 miles begins with the first steps," it is also clear that we can take those first steps now in the laboratory. Given that Casimir and related effects indicate the possibility of tapping the enormous residual energy in the vacuum-fluctuation ZPE, and the demonstration in cavity QED that portions of the ZPE spectrum can be manipulated to produce macroscopic technological effects such as the inhibition of spontaneous emission of excited states in quantum systems, it would appear that the first steps along this path are visible. This, combined with newly-emerging concepts of the relationship of gravity, inertia and warp drive to properties of the vacuum as a manipulable medium, indicate yet further reaches of possible technological development, although requiring yet unforeseen breakthroughs with regard to the possibility of engineering vacuum fluctuations to produce desired results.

Where does this leave us? As we peer into the heavens from the depth of our gravity well, hoping for some "magic" solution that will launch our spacefarers first to the planets and then to the stars, we are reminded of Arthur C. Clarke's phrase that highly-advanced technology is essentially indistinguishable from magic. Fortunately, such magic appears to be waiting in the wings of our deepening understanding of the quantum vacuum in which we live.

REFERENCES

Lee, T.D. (1988) *Particle Physics and introduction to Field Theory*, Harwood Academic, London.

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Feynman, R.P., and Hibbs, A.R. (1965) *Quantum Mechanics and Path Integrals*, McGraw-Hill, New York.

Forward, R.L. (1984) "Extracting electrical energy from the vacuum by cohesion of charged foliated conductors," *Phys. Rev. B*, Vol. 30, No. 4, pp. 1700-1702.

Casimir, H.G.B. (1948) "On the attraction between two perfectly conducting plates," *Proc. Kon. Ned. Akad. van Weten.*, Vol. 51, No. 7, pp. 793-796.

Lamoreaux, S.K. (1997) "Demonstration of the Casimir force in the 0.6 to 6μm range," *Phys. Rev. Lett.*, Vol. 78, No. 1, pp. 5-8.

Milonni, P.W., Cook, R.J., and Goggin, M.E. (1988) "Radiation pressure from the vacuum: Physical interpretation of the Casimir force," *Phys. Rev. A*, Vol. 38, No. 3, pp. 1621-1623.

Cole, D.C., and Puthoff, H.E. (1993) "Extracting energy and heat from the vacuum," *Phys. Rev. E*, Vol. 48, No. 2, pp. 1562-1565.

Puthoff, H.E., (1990) "'The energetic vacuum: implications for energy research," *Spec. in Sci. and Tech.*, Vol. 13, No. 4, pp. 247-257.

Puthoff, H.E., and Piestrup, M.A. (1997) "On the possibility of charge confinement by van der Waals/Casimir-type forces," subm. to *Phys. Lett. B.*

Shoulders, K.R. (1991) "Energy conversion using high charge density," U.S. Patent No. 5,018,180, issued May 21, 1991.

Schwinger, J. (1993) "Casimir light: The source," *Proc. Natl. Acad. Sci.*, Vol. 90, pp. 2105-2106.

George, D.R., and Stringham, R.S. (1996) "Technical report on the demonstration of new technology producing heat and nuclear products via cavitation induced micro-fusion in the E-Quest Sciences Mark II research device," EPRI Project Final Report, Work Order #3170-28, Palo Alto, CA, May 1996.

Mead, Jr., F.B., and Nachamkin, J. (1996) "System for converting electromagnetic radiation energy to electrical energy," U.S. Patent No. 5,590,031, issued Dec. 31, 1996.

Puthoff, H.E. (1987) "Ground state of hydrogen as a zero-point-fluctuation-determined-state," *Phys. Rev. D.* Vol. 35, No. 10, pp. 3266-3269.

Haroche, S, and Raimond, J.-M. (1993) "Cavity quantum electrodynamics," *Sci. Am.*, April 1993, pp. 54-62.

Rueda, A., Haisch, B. and Cole, D.C. (1995) "Vacuum zero-point field pressure instability in astrophysical plasmas and the formation of cosmic voids, " *Astrophys. J.*, Vol. 445, pp. 7-16.

Sakharov, A. (1968) "Vacuum quantum fluctuations in curved space and the theory of gravitation," *Sov. Phys.-Dokl.*,Vol. 12, No.11, pp. 1040-1041.

Puthoff, H.E. (1989, 1993) "Gravity as a zero-point-fluctuation force," *Phys. Rev. A*, Vol. 39, No. 5, pp. 2333-2342; Vol. 47 No. 4, pp. 3454-3455.

Haisch, B., Rueda, A., and Puthoff, H.E. (1994) "Inertia as a zero point field Lorentz force," *Phys. Rev. A*, Vol. 49, No. 2, pp. 679-694.

Puthoff, H. E. (1989, 1991) "Source of vacuum electromagnetic zero-point energy," *Phys. Rev. A*, Vol. 40, No. 9, pp. 4857-4862; Vol. 44, No. 5, pp. 3385-3386.

Forward, R.L. (1996) "Mass modification experiment definition study", *J. Sci. Exploration*, Vol. 10, No. 3, pp. 325-354. [Also in *Infinite Energy*, Issue #9, pp.53-64.]

Forward, R.L., and Miller, L.R. (1967) "Generation and detection of dynamic gravitational-gradient fields," *J. Appl. Phys.*, Vol. 38, No. 2, pp. 512-518.

Alcubierre, M. (1994) "The warp drive: Hyper-fast travel within general relativity," *Class. Quant. Grav.*, Vol. 11, pp. L73-L77.

Puthoff, H.E. (1996) "SETI, the velocity-of-light limitation, and the Alcubierre warp drive: An integrating overview," *Phys. Essays*, Vol. 9, No. 1, pp. 156-158.

Pfenning, M.J., and Ford, L.H. (1997) "The unphysical nature of 'warp drive' ," subm. to *Class. Quant. Grav.*

Morris, M., and Thorne, K.S. (1988) "Wormholes in spacetime and their use for interstellar travel: A tool for teaching general relativity," *Am. J. Phys.*, Vol. 56, No. 5, pp. 395-412.

Visser, M. (1996) *Lorentzian Wormholes*, AIP Press. Woodbury, NY.

Abstract of another recent publication on ZPE:

Speculations in Science and Technology **20**, 99 114 (1997).

Physics of the zero-point field: implications for inertia, gravitation and mass

BERNHARD HAISCH, ALFONSO RUEDA, AND H.E. PUTHOFF

Previous studies of the physics of a classical electromagnetic zero-point field (ZPF) have implicated it as a possible basis for a number of quantum phenomena. Recent work implies that the ZPF may play an even more significant role as the source of inertia and gravitation of matter. Furthermore, this close link between electromagnetism and inertia suggests that it may be fruitful to investigate to what extent the fundamental physical process of electromagnetic radiation by accelerated charged particles could be interpreted as scattering of ambient ZPF radiation. This could also bear upon the origin of radiation reaction and on the existence of the same Planck function underlying both thermal emission and the acceleration-dependent Davies-Unruh effect. If these findings are substantiated by further investigations, a paradigm shift would be necessitated in physics. An overview of these concepts is presented thereby outlining a research agenda which could ultimately lead to revolutionary technologies.

Keywords: zero-point field, stochastic electrodynamics; quantum electrodynamics; quantum vacuum; inertia; gravitation; dark matter; mass; relativity

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NASA Breakthrough Propulsion Physics Workshop (August 12-14, 1997) - PRE-WORKSHOP INFORMATION - INVITED PRESENTATIONS

(1) Lawrence Krauss, Case Western Reserve University, Cleveland OH: "Physics Possibilities and Practicalities of Propellantless Propulsion" (30 min.)
The author will briefly review the physics ideas behind manipulating spacetime for propellantless propulsion, and why it requires new physics. The author will then explain why such spacetime manipulations, even allowing for new physics, is probably impossible in practice, and useless in principle, for the purposes interstellar travel.

(2) Harold Puthoff, Institute for Advanced Studies at Austin, TX: "Can the Vacuum be Engineered for Spaceflight Applications?: Overview of Theory and Experiments" (30 min.)
Quantum theory predicts, and experiments verify, that empty space contains an enormous residual background energy known as zero-point energy (ZPE). This energy is of interest to technologists in such examples as the inhibition of spontaneous emission, the generation of short-range attractive forces (Casimir forces), and the possibility of accounting for the sonoluminescence phenomena. For spaceflight, the topics range from fundamental issues (inertia), through laboratory attempts to extract useful energy from vacuum fluctuations, to scientifically-grounded extrapolations concerning "engineering the vacuum" (e.g. for "warp-drives").

(3) Raymond Chiao, University of California at Berkeley, CA: "Tunneling Times and Superluminality" (40 min.) Recent experiments and theories on the time it takes a photon or an electromagnetic wave packet to tunnel across a barrier will be reviewed, including work in which the authors have found that photons tunnel at effective speed of 1.7 times the speed of light at midgap through a photonic band-gap tunnel barrier.

(4) John Cramer, University of Washington, Seattle, WA: "Quantum Non-locality and Possible Superluminal Effects" (30 min.)
EPR experiments demonstrate that standard quantum mechanics (QM) exhibits *nonlocality*, the enforcement correlations between separated parts of an entangled quantum system across spacelike separations. Nonlocality will be clarified using the transactional interpretation of QM, and the possibility of superluminal effects fro nonlocality, nonlinear QM, and tunneling will be examined.

(5) Ronald J. Koczor, and David Noever, NASA Marshall Space Flight Center, Huntsville, AL: "Experiments on the Possible Interaction of Rotating Type II YBCO Ceramic Superconductors and the Local Gravity Field " (45 min.)
Various researchers have reported observations of gravity effects in the vicinity of rotating superconductors in strong magnetic fields. Since such a coupling could have enormous transportation implications, NASA's Marshall Space Flight Center started (in 1996) a small experimental effort to investigate such a coupling. This presentation will describe this project, including the experimental methods, results to date, and related work.

(6) Robert Forward, Forward Unlimited, Clinton, WA: "Dimensional Control of Casimir Energy" (30 min.)

(7) Alfonso Rueda, California State University, Long Beach, CA: "Inertial Mass as Reaction of the Vacuum to Accelerated Motion" (20 min.)
Preliminary analysis of the momentum flux of the classical electromagnetic version of the quantum vacuum,

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TABLETOP FUSION

by Larry Niven

Reprinted with the permission of the venerable science fiction/fact writer. This chapter appeared in Larry Niven's *Bridging the Galaxies*, 1993

When cold fusion broke into the news, *Reason Magazine* asked me for an article on how it would affect the future.

The news had gone cold by the time I turned it in. They bought it anyway, but chose not to publish it.

The subject is warming up again.

The viewpoint of the physicists here is easy to understand. They spend money like a drunken government, trying to get enough heat and pressure to make solar-style fusion work. The money is committed years in advance. They did not warm to the notion of being beaten by chemists. Now they've admitted that something is going on: They get radiation, tritium, and other indications that it ain't just chemistry. Nuclear fusion is happening at some level.

But even without that, it's a fit subject for science fiction.

•

When the news hit, I bought stock in platinum mines. I had to explain to my broker that I had no interest in platinum, just the mines. They're the only source of palladium. I held for a bit, then sold it. It isn't that I lost faith. But it seems that the lattice structure of the palladium electrodes somehow absorbs the shock of two deuterium nuclei becoming one helium nucleus, so that the nucleus doesn't have to spit out most the energy as a neutron. Palladium can't be the only substance with the right lattice structure.

Now my stockbroker wants to hire me. The man she actually wants is Jerry Pournelle: these were his suggestions.

I'm a science fiction writer. It always feels as if I actually know all that stuff. In May 1989 I was prepared to tell you:

The wonderful thing is that you'll know, *and* soon. *The experimental set up at the University of Utah is cheap. Pons and Fleischmann used their own money. For a hundred thousand dollars you can try it yourself! A lot of universities and laboratories will. Before I have quite finished typing, you should know whether this is another Dean Drive or a discovery to rank with the electric motor.*

Hah! A panel discussion at Baycon in San Jose in May changed my perspective.

What's the melt? Lithium deuteroxide, but was it doped with something else? Is it the deuterium that undergoes fusion, or the lithium? Or both?

Platinum and palladium electrodes seem to be the key. But "making the electrodes is a black art." You do everything right, meticulously, and you still don't know what you'll get. Panelists spoke of electrodes used for isotope separation: melted in vacuum, and recast, fifteen times! After the tenth remelting, a spectrum change indicates that the melt is still losing trapped gas!

That black art is called alchemy, and it's old. Or else it's the infant science of chaos, like weather prediction, the stock market, disease control, and a score of other undisciplined disciplines. Results are very sensitive to initial conditions. Wobble the sixth or tenth decimal place, and everything changes. A bright calm day becomes a hurricane. A vaccine that had AIDS stopped cold hits a sudden spike in the death rate.

Pons and Fleischmann are saying very little. Their reputations are solid; their papers are not; their methods are secret pending patent applications. The brightest friends I've got are all using the word "intuition."

So here's the future. I'm making optimistic assumptions because that's what *Reason* asked for, and because it makes the most interesting story.

•

If tabletop fusion is real, then we know something about it.

1. A tabletop fusion plant—call it a fusor—would be a billion times cleaner (per output in kilowatts) than a hot plasma fusion plant. That makes it cleaner than every form of power now in use except hydroelectric (which is clean if you're not downstream when the dam goes) and solar.

2. Interestingly, the tabletop fusor has no more weapons potential than a teddy bear. There's not enough power output for a decent weapons laser, and if anything goes wrong, it just stops.

You can't build it bigger because there's an upper temperature limit. The fusion takes place in the crystal lattice of the palladium, where an electric charge can concentrate deuterium nuclei to an effective 10^{24} atmospheres of pressure. That's close enough to allow fusion. Swell; but if the electrodes melt (and the theory doesn't), the crystal lattice in the palladium is lost and everything stops.

So don't expect big power plants: there's no economy of scale. There's no way to make it explode either.

3. Are we talking about running a car around the world on a quart of lithium deuteride? Today's gas-driven car always bursts into a fireball, whatever you do to it, at least in the movies. Deuterium burns like hydrogen, sure, but a quart of the stuff isn't terribly dangerous.

I can't see fusor automobiles. The fusor won't get that small, not soon.

But we might see eighteen-wheel trucks running on fusors. Small businesses and apartment buildings and individual houses could have fusors in their basements, if the price dropped enough. The big power companies would lose customers.

Eighteen-wheelers use a lot of oil. The United States produces fuel enough to run our cars ourselves, or near enough. I'm surprised that Pons and Fleischmann haven't published everything they've got, damn quick, before Iran sets a price on their heads. They can do more harm to the oil-producing nations than any novel.

Run the eighteen-wheelers on deuterium and we'll find city air growing cleaner.

With small power plants in our basements, we would attain an independence we've long thought to be lost....

Wait a minute. We've seen how difficult it is to get one of these things to work at all. Wouldn't that push the commercial product a long way into the future? and make it hellishly expensive to manufacture? and a pain in the ass to own?

Yes. Sorry. For the foreseeable future, the fusor will be a rich man's toy. And he's a survivalist. And he still hasn't stopped paying his electric bill.

Then again: *Everything* starts as a rich man's toy. *Be the first on your block....* The wealthy test new products for us. The best designs ultimately surface, dependability goes up and the price drops. Maybe by 2050 AD.

4. Don't expect high efficiency here. This is a heat engine, but we've got to keep the electrodes below the melting point. Thermodynamics tells us that the *maximum* efficiency of a heat motor depends on the ratio between operating and ambient temperature, counting from absolute zero.

That's not good, but it's not awful.

Contrast the OTEC power plant (Ocean Thermal Energy Conversion). It gets its power from the difference in temperature between the surface and bottom of an ocean. It's expected to run on a temperature difference of ten Centigrade degrees. A seabottom is always at 4°C = 277°K; so the ratio would be 10/277 = theoretical maximum of 3.6% efficiency. Lousy. But there's a lot of ocean; and seawater is *very* conductive; and because you're stirring up nutrients in the seabottom mud, the only pollution is an excess of fish. Low efficien-

Continued on page 78

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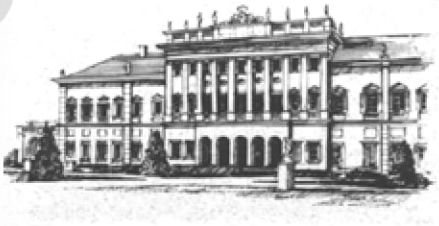

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cy, clean running, infinite fuel supply. . . and OTEC remains useful, if you have a warm water ocean.

Fusors are fueled by the deuterium in water. Low efficiency, clean running, infinite fuel. We could use up all of Earth's deuterium over the next 100,000 years and not deplete the seas by much, because most seawater isn't deuterium oxide. And when we run out, the moons of the outer planets are water cores inside ice shells!

5. Still, fusors will operate best where it's *coldest*, where the heat-sink is most useful.

Hey, that's interesting! Solar power needs sunlight. An OTEC operates best in tropic summer seas. Even *orbiting* solar plants would deliver power most easily to the equator. But a fusor operates best during a six-month winter night at the Antarctic Pole!

If you put a fusor in every basement in Alaska, Siberia, Greenland, and Antarctica, and institute a regular deuterium delivery, what do you get?

Civilization. Where nothing lives, that's where you want to put your industry. What makes civilization work is a good heat-sink.

Every nation that borders the Arctic Circle is already exploiting that environment to some extent, except Canada and the United States. But fusors could make the North Pole worth having and the South Pole worth even more (because there's land under it.) The Soviets could laugh at our warm-water ports.

6. I was in a physics class at Cal Tech the day I realized that the proper place for a power plant is Pluto. My teacher was not impressed. Bright guy, but all these decades later, he still hates science fiction.

So let's talk about space.

Launch to orbit has always been the bottleneck, and the fusor won't help us here. The power output will be too low. But "Once you're in orbit you're halfway to anywhere," said Robert Heinlein. The fusor brings everything closer.

A fusor is the obvious power plant for a lunar base, or for anyplace in the solar system that experiences long nights.

Light-sails are still the way to explore the inner solar system. But inward from Earth there's not much besides the sun. Outward from Earth, the sunlight gets thin. You want your own power supply even if you keep the sail. The black sky makes a terrific heat sink, too.

Ad Astra Per Aspera!

the NIVEN file

Born April 30, 1938, in Los Angeles, California, USA.
Father: Waldemar Van Cott Niven.
Mother: Lucy Estelle Doheny Niven Washington.
Raised in Beverly Hills, California. Hawthorne Public School (Beverly Hills); Cate School in Carpinteria.

Entered California Institute of Technology, 1956. Flunked out February, 1958, after discovering a book store jammed with used science fiction magazines.

Honest employment: gas station attendant, summer 1960.

Graduated Washburn University, Kansas, June 1962: BA Mathematics with Minor in Psychology. Half the university scattered to the winds by a tornado a month after I left.

First story publication: "The Coldest Place," Worlds of If, December 1964.

Married Marilyn Joyce Wisowaty, September 6, 1969. We met at the NYcon, 1967. No children. We reside in Tarzana, California.

I have written fiction at every length; and speculative articles, speeches for high schools and colleges, television scripts, political action in support of the space program, a total revision of the background universe for DC Comics' Green Lantern, and (with eight others) the Malibu Graphics Multiverse.

I've collaborated with a wide variety of writers.

INTERESTS:

Science fiction conventions. Computerized games. AAAS meetings and other gatherings of people at the cutting edge of the sciences. Comics. Folksinging. Yoga and other approaches to longevity.

Saving civilization and making a little money. Moving humankind into space by any means, but particularly by making space endeavors attractive to commercial interests.

In 1982 Jerry Pournelle talked me and Marilyn into hosting a gathering of the top minds in the space industry in an attempt to write a space program, with goals, timetables, costs. The Citizens Advisory Council for a National Space Policy has met five times over five years, for harrowing three-day weekends. The attendees include spacecraft designers, businessmen, NASA personnel, astronauts, lawyers. Adding science fiction writers turns out to be stunningly effective. We can translate: we can force these guys to speak English.

We've had some effect on the space program...not enough, but some. In '93 we watched McDonnell-Douglas's DC-X1 fly. It's a toy version of a single stage ground-to-orbit spacecraft, and the Council generated it. It now appears likely that the full-sized version will be built under the name X-33 and flown by NASA.

I grew up with dogs: Keeshonds, the show dogs my mother has raised for fifty years. I live with cats. I have passing acquaintance with raccoons and ferrets. Associating with nonhumans has surely given me some insight into alien intelligences.

I've written on computers since 1978. Currently I use an IBM-compatible with Q&A Write *and* Word for Windows, a laser printer and a Flexscan terminal with an enormous screen set for white-on-blue. I don't know anything else about computers. What I do is, I buy what Jerry tells me to. He's the Users Column for *BYTE Magazine*.

###

AWARDS: Hugos (or Science Fiction Achievement Awards) for "Neutron Star", 1966; RINGWORLD, 1970; "Inconstant Moon", 1971; "The Hole Man", 1974; "The Borderland of Sol", 1975. Nebula, Best Novel 1970: RINGWORLD. Ditmars (Australian, Best International Science Fiction) for RINGWORLD, 1972, and PROTECTOR, 1974. Japanese awards for RINGWORLD and "Inconstant Moon," both awarded 1979. Inkpot, 1979, from San Diego Comic Convention. Various Guest-of-Honor plaques.

Doctor of Letters (D. Litt.) from Washburn University, May 1984.

Latest novels:

With Jerry Pournelle and Steven Barnes, BEOWULF'S CHILDREN, a sequel to THE LEGACY OF HEOROT.

THE RINGWORLD THRONE from Del Rey, 1995

DESTINY'S ROAD from TOR, June 1997.

Work in progress:

SVETZ AND THE BEANSTALK

THE BURNING CITY, with Jerry Pournelle

THE SHIPS OF HUMAN SPACE, artwork by Aldo Spadoni, text by Larry Niven

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September 26, 1997
Re: ICCF-7 April 19-24, 1998 Vancouver, Canada

Greetings!

ICCF-7 is now just a little over six months away, and it is time to make final plans.

Enclosed in this package are instructions for submitting official abstracts. Please return the yellow abstract form, by mail, to the ICCF-7 secretariat prior to November 1, 1997, in order to be considered for an oral or poster presentation at ICCF-7. A list of oral and poster presenters will be announced in mid-January, 1998.

A blue ICCF-7 registration form is also enclosed. Persons submitting abstracts must return this form with payment before November 1, 1997 along with their abstract. The conference registration fee is $450 USD until December 31, 1997, and $500 USD afterwards. A $75 USD supplemental fee enables spouses to attend the reception, banquet, and brunch. A refund of the registration fee is available to persons who submit abstracts that are not selected for either oral or poster status.

Everyone planning to attend ICCF-7 is expected to make their own, direct hotel arrangements on a first-come first-serve basis. Over 375 rooms have been blocked at five nearby hotels at special conference rates ranging from $90-185 USD per night. Additional rooms are available, if needed.

Additional information about abstract submittal, registration, and hotel bookings is enclosed along with a general Fact Sheet for ICCF-7. The website for ICCF-7 is now functional at:

http://www.ICCF-7.org

It is our intention to use the website as a major vehicle to disseminate information about ICCF-7. Please visit the website and provide suggestions for improvement. Watch for our next ICCF-7 mailing near the end of this year.

Best wishes,
Fred Jaeger
Organizing Chairman

ICCF-7 c/o ENECO, 391-B CHIPETAWAY, SALT LAKE CITY, UTAH 84108 USA,
PH (801) 583-2000. Fx (801) 583-6245 • jaeger@ENECO-USA.com

ICCF-7 FACT SHEET

PURPOSE

Welcome to the 7th International Conference on Cold Fusion (ICCF-7). The study of low energy induced nuclear reactions in solids has continued to mature, and many new and compelling scientific findings are becoming known. ICCF-7 provides a unique international forum for direct interaction among top scientists in the field. The quality and diversity of on-going research and commercial implications make ICCF-7 an important event that should not be missed.

DATE AND VENUE

April 19 - 24, 1998
Vancouver Trade & Conventional Centre
Vancouver, Canada

OFFICIAL CONFERENCE LANGUAGE

English

CONFERENCE SECRETARIAT

ICCF-7 Secretariat
c/o ENECO
391-B Chipeta Way
Salt Lake City, Utah 84108 USA

Phone (801) 583-2000 Fax (801) 583-6245 e-mail jaeger@eneco-usa.com ICCF-7 website http://www.ICCF-7.org

ICCF-7 INTERNATIONAL ADVISORY COMMITTEE (IAC)

Rotating Chairperson for ICCF-7:
Mr. F. Jaeger (USA)

Honorary Co-Chairpersons Emeritus:
Dr. Martin Fleischmann (UK)
Dr. Stanley Pons (France)

Committee Members:

Prof. T. Bressani (Italy)
Prof. H. Ikegami (Japan)
Mr. R. Machacek (Canada)
Dr. M. McKubre (USA)
Mr. K. Namba (Japan)
Prof. M. Okamoto (Japan)

Prof. G. Preparata (Italy)
Prof. N. Samsonenko (Russia)
Prof. C. Sanchez (Spain)
Dr. F. Scaramuzzi (Italy)
Dr. M. Srinivasan (India)
Prof. X.Z. Li (China)

ICCF-7 LOCAL ORGANIZING COMMITTEE (LOC)

Scientific Chairman: Prof. G. Miley - Univ. of Illinois
Organizing Chairman: Mr. Fred Jaeger - ENECO

Prof. P. Hagelstein - M.I.T.
Prof Y. Kim - Purdue
Dr. Y. Kucherov- ENECO
Mr. R. Machacek - Ontario Hydro
Dr. D. Nagel - Naval Research Lab

Prof. R. Oriani - Univ. of Minnesota
Dr. T. Passell - EPRI
Dr. Carol Storms - Los Alamos (retired)
Dr. E. Storms - Los Alamos (retired)
Dr. F. Tanzella - SRI

CALENDAR OF EVENTS

- September 26, 1997:
  Official call for one-page abstracts.
- November 1, 1997:
  Deadline for abstracts & registration for presenters.
- January 1, 1998
  Conference fee increases to $500 USD.
- January 15, 1998:
  Final notification of oral or poster status.
- January 30, 1998:
  Final amendments for abstracts to be published in ICCF-7 Program Manual &website.
- April 19, 1998:
  Deadline for final papers for inclusion in the ICCF-7 Proceedings (to be distributed summer '98)
- April 19-24th:
  ICCF-7 Vancouver, Canada

Continued on page 80

CALENDAR

Third Russian Conference on Cold Fusion and Nuclear Transmutation
October 1—8, 1995
Sochi, Russia

Power-Gen '95
(CETI cell demo)
Anaheim, California
December 5-7, 1995

New Ideas in Natural Sciences
June 17-22
St. Petersburg, Russia

1996 International World Energy System Conference
June 19-21, 1996
Toronto, Canada

2nd Low-Energy Transmutation Meeting
College Station, Texas
Sept.13-14, 1996

ICCF6—Sixth International Conference on Cold Fusion
October 13-18, 1996
Hokkaido, Japan

Building Energy—Insuring a Sustainable Future
March 12-15, 1996
(Sponsor: Northeast Sustainable Energy Association)
Radisson Hotel and Conf. Center
Cromwell, Connecticut

INTERNATIONAL SYMPOSIUM ON NEW ENERGY
(Sponsor: Academy for New Energy)
May 23-26, 1997
Denver, Colorado

International Tesla Society Meeting
July 10-13, 1997
Colorado Springs, CO

Cold Fusion Conference in Italy at Asti
November 27-30, 1997
Asti, Italy

ICCF7—Seventh International Conference on Cold Fusion
April 19-24, 1998
Vancouver, CANADA

ICCF-7 VANCOUVER "The Best Ever!"

New Energy Times Archive

ICCF-7
VANCOUVER
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ICCF-7 DAILY FORMAT

08:30 - 09:10 Invited presentation of the day's topic.
09:10 - 09:30 Follow-up discussion and questions.
09:30 - 09:55 Oral presentation #1 *
09:55 - 10:20 Morning break
10:20- 10:45 Oral presentation #2
10:45 - 11:10 Oral presentation #3
11:10 - 11:35 Oral presentation #4
11 :35 - 12:00 Oral presentation #5
12:00 - 13:30 Lunch
13:30 - 15:00 15-20 oral previews of poster presenters (3-5 min/ea)
15:00 - 15:30 Afternoon break
15:30 - 17:30 Poster presentations
19:30 - 20:30 Evening workshops; three nights

* Regular oral presentations will be 20 minutes followed with a 5 min question and answer period. All oral presenters in the morning will also host a poster follow-up session in afternoon.

ICCF-7 HOTEL POLICY

All ICCF-7 activities will be held in a government owned trade & convention center called One Canada Place on downtown Vancouver's scenic waterfront. ICCF-7 organizers have negotiated special conference rates for a limited block of rooms at each of five downtown hotels that are within convenient walking distance to the conference center. Special ICCF-7 group rates are applicable from Saturday, April 18th through Saturday, April 25th.

All ICCF-7 participants are responsible for directly booking and paying for their stay at the hotel of their choice on a first-come first-serve basis. Early hotel bookings are strongly encouraged because there are only a limited block of rooms available at each hotel, and all conference hotels will incrementally release unreserved rooms for general public sale at 90, 60, and 30 days before the conference. Reservations generally require credit card payment for your first night's stay. Full payment of the balance is required at checkout.

HOTEL SUMMARY

(actual prices are subject to exchange rates at time of payment)

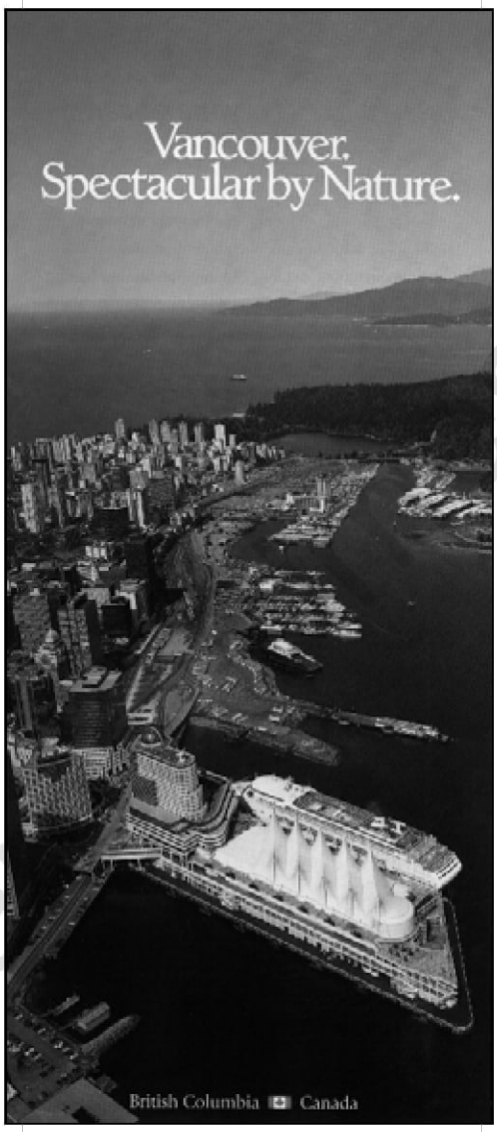
PAN PACIFIC HOTEL is a luxurious hotel that sits directly on top of the ICCF-7 conference center. A simple elevator trip will take you to all ICCF-7 activities.Daily price is approximately $185 USD for single or double occupancy, including taxes. For reservations phone 1-800-937-151 5 or fax (604) 895-2469 mention "cold fusion" group code. 75 rooms are initially blocked for ICCF-7.

THE WATERFRONT HOTEL is across the street from the ICCF-7 conference center, and is directly connected by an underground shopping arcade with restaurants. Daily price is approximately $175 USD for single or double occupancy, including taxes. For reservations phone 1-800-441-1414 or fax (604) 691-1999 mention "KO419" group code. 100 rooms are initially blocked for ICCF-7.

DAYS INN is an economical hotel two blocks from the conference center. Daily price is approximately $90 USD for a one-bed room and $100 for a two-bed room, including taxes. For reservations phone (604) 681-4335 or fax (604) 681-7808 mention "ICCF-7" group code. 20 singles and 20 doubles are initially blocked for ICCF-7.

RENAISSANCE HOTEL is three blocks from the conference center overlooking the Burrard Inlet Harbor. Daily price is approximately $140 USD for single or double occupancy with city view and $160 USD for single or double with harbor view. For reservations phone 1-800-468-3571 or fax (604) 689-4358 mention "ICCF-7" group code. 60 rooms are initially blocked for ICCF-7.

HYATT REGENCY HOTEL is four blocks (7-10 minute walk) from the conference center. Daily price is approximately $165 USD for single and $185 for double occupancy, including taxes. For reservations phone 1-800-233-1234 or fax 1604) 643-5812 mention "ICCF-7" code. 100 rooms are initially blocked for ICCF-7.



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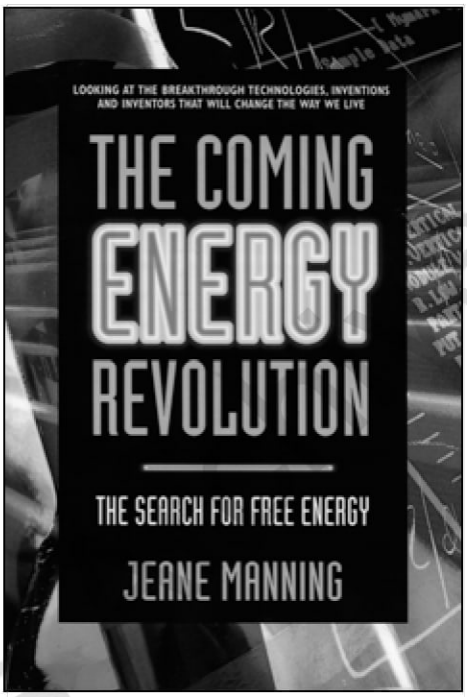

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The author, Frank Znidarsic, has a B.S. in Electrical Engineering from the University of Pittsburgh, has an Associate in Science from Saint Francis College, and is a registered professional engineer in the state of Pennsylvania.

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TAPE#1

Dr. Eugene F. Mallove
(Cold Fusion Technology, Concord, NH)
"Cold Fusion and New Energy Technology - An Overview"

Dr. Peter Graneau
(Northeastern University Center for Electromagnetic Research) "Anomalous Forces in Water Plasma Explosions"

TAPE#2

Buford ("Ray") Conley
(MIT, graduate student, Dept. of Aero/Astro Eng.)
"Light Water Excess Heat Experiments"

Fred Jaeger
(ENECO, Salt Lake City)
"Patents and Commercialization"

Professor Peter L. Hagelstein
(MIT Dept. of Electrical Engineering and Computer Science) "Cold Fusion: What We Know and What We Don't Know"

TAPE#3

Professor Peter Hagelstein
(CONTINUED from TAPE #2)
"Cold Fusion: What We Know and What We Don't Know"

Professor Keith Johnson
(MIT Dept. of Materials Science and Engineering)
"Progress in the Theory of Excess Heat" *and Excess Heat*- The Movie, now being made by Hollywood!

James L. Griggs
(Hydro Dynamics, Inc., Rome, Georgia, USA)
"The Hydrosonic Pump: Excess Power and Other Effects"

TAPE#4

Bertil Werjefelt
(PolyTech(USA), Hawaii)
"Energy from Magnetic Materials and Magnetic Fields"

Dr. Eugene F. Mallove
(Cold Fusion Technology, Concord, NH)
Concluding Remarks

The tapes include the speakers' presentations as well as question and answer sessions. There is footage of the Hydrosonic Pump under test as well as close-up footage of rotor surface melting effects. Bertil Werjefelt shows footage of experiments in his own laboratory. There are scenes of Japanese researchers from Sumitomo, Hitachi, and other companies and universities now involved in their claimed extraction of energy from magnetic materials. These efforts are now said by these researchers to be proceeding toward commercialization. Actual experiments are seen in progress. The tapes are VHS cassettes in NTSC format and range from 120 to 127 minutes each.

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COLD FUSION MEETING IN ITALY—NOV. 27-30, 1997

FIRST ANNOUNCEMENT: 9/23/97

Joint III ASTI WORKSHOP ON COLD FUSION
&
V Convegno sullo Stato della Fusione Fredda in Italia

W J M F Collis
Strada Sottopiazzo 18
14056 Boglietto di Costigliole (AT)
ITALY

Tel +39-141-968602
Email collis@netcity.it
Workshop web site: netcity.it\coldfusion

Dear Colleague,

Italy currently hosts some 8 to 10 Cold Fusion experiments and a year after the ICCF6 conference in Hokkaido it is desirable to discuss the current state of the art.

As in previous years, we are organizing another international workshop near Asti this Autumn (provisionally Thursday 27 til Sunday 30 November 1997) at the Hotel Villa Riccardi, Via al Monte 7, Rocca d'Arazzo(AT).

We will book the hotel on your behalf. Asti is the provincial capital in the Piemonte of north west Italy, famous for its wine and food. The climate is quite cold in winter with overnight frost likely. Hotel accommodation with full board will cost 95,000 lire per night (about $60).

The workshop language will be English. If you would like to participate or have any comments, please send email to collis@netcity.it or telephone ++39-141-968602. If you would like to make an oral (about 45 minutes) or poster contribution, please specify the title at this time. Sponsorship of the workshop will be dependent on proposing high quality presentations so please reply as soon as possible.

Workshop sponsors include INFN, University of Rome III, Eneco Ltd. Check out the workshop web site www.netcity.it/coldfusion for the latest workshop details.

Yours sincerely
Bill Collis
(Local Organizer)

CONFERENCE Status from Bill Collis:
10 November 1997

Asti Workshop on Anomalies in Hydrogen / Deuterium loaded Metals

Dear Colleague,

I am pleased to report there has been excellent response to our invitation to the workshop. The hotel is now full, so if you have not confirmed your attendance already, you will probably be reserved another hotel (more expensive) requiring a car to get to the workshop. If you are presenting a paper please specify the title, and if possible, bring a copy with you for copying and distribution.

The workshop has received significant sponsorship and the press conference and prize-giving will go ahead as planned. If you would like to nominate a candidate for the truffle prize please feel free to do so.

Participants may be interested to know that the Cincinnati Group will be bringing their LENT-1 kit to the workshop!

Check out the workshop web site www.netcity.it/coldfusion for the latest details.

Yours sincerely,
Bill Collis (Local Organizer)

Participants as of 10 November 1997

Mr. William Collis	Eneco Ltd
Dott. Francesco Scalfari	ASSTA
Dott. Ing. Alfredo Mancini	Orim srl
Dott. Roberto Irsuti	21mo Secolo
Ing. Vito Cela	Fiat Avio SpA
Prof. Carlos Sanchez Lopez	Universidadde Madrid
Dr. Giovanna Selvaggi	INFN, Frascati
Dr. Antonio Spallone	INFN, Frascati
Dr. Francesco Celani	INFN, Frascati
Dr. M. Nakamura	Euresys
Dr. Peter Glück	Institute of Isotopic & Molecular Technology
Prof. Felice Iazzi	INFN, Torino
Prof. Tullio Bressani?	INFN, Torino
Dr. S Veronesi	Universita di Siena
Prof. Robert Huggins+1	Kiel University
Dott. Ing. Guido Clerici	Societa Industriale Accumulatori srl
Dott.ssa A. Rizzo	Universita di Bologna
Prof. Giuliano Mengoli	IPELP - CNR
Dott. Ettore Ruberti	ENEA
Ing. Fausto Lanfranco	Fiat-Hitachi-Excavators
Mr. Bart Simon	UCSD
Dott. Diego Macerata	Centro Ricerche Fiat
Prof F. Premuda	Universita di Bologna
S. De Pasca	Universita di Bologna
E. Costa	Universita di Bologna
Prof Christos Stremmenos	Universita di Bologna
Prof L Daddi	Accademia Navale di Livorno
Dr Jean de Lagarde	
Prof. Martin Fleischmann	University of Southampton
Prof. George Miley	University of Illinois
Dr. Fulvio Frissone+2	Universita di Catania
Dr. M. McKubre	Stanford Research Institute
Dr. Jacques Dufour	Shell Research SA, Paris
Prof. J. P. Biberian+1	Universite' de Marseilles
N. Asami	Institute of Applied Energy
H. Kaminura	Institute of Applied Energy
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Oral Presentations

W. Collis	Introduction
J. P Biberian	Title to be announced
J. Dufour	Effect of Hydrex on a photo-electric cell
P. Glück	The Reproducibility problem in Cold Fusion Systems
F. Celani	The Effect of Gamma-Beta phase Interface on (H/D) Overloading
G Mengoli	The Nickel-K_2CO_3 System: an electro and calorimetric investigation
N. Asami	On the Material Behaviour of Highly Deuterated Palladium
H. Kamimura	Excess Heat Measurement by Fuel Cell Type Electrolysis
T. Bressani /F Iazzi	Title to be announced
C. Sanchez	Cold Fusion Experiments with Titanium
S. Veronesi	Study of the Ni-H System at 600-800 K
G. Miley	Transmutation Studies using Thin Film electrolysis.
M. McKubre	Materials Issues of Loading Deuterium into Palladium, and the Association with Excess Heat Production
W. Collis	Cold Fusion or Cold Fission?
J. P. Vigier	Title to be announced
H. Fox	Plasma-Injected Transmutation on Using High-Density Charge Clusters
F. Premuda	A Unified Theory of Cold Fusion and Superconductivity ...

Posters

A. Rizzo	A flow calorimeter study of the Ni/H System.
F. Frissone	Interaction between Plasmons of metal and deuterons.
R. Shimada	Nuclear Products Measurements by Electrolysis - Vacuum combined System

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PROVISIONAL WORKSHOP PROGRAM

Wednesday 26 November
Arrival at Hotel Villa Riccardi.

Thursday 27 November
Presentation of Papers
Round Table Discussions

Friday 28 November
"Colloqui sulla Fusione Fredda"
Press Conference and Prizegiving
at the Cassa di Risparmio di Asti.
Luncheon Banquet at the Hotel Reale.
Excursion to the Contratto wine cellars.

Saturday 29 November
Presentation of Papers
Round Table Discussions.

Sunday 30 November
Presentation of Papers.
Departure.

HOW TO GET TO VILLA RICCARDI

Four international airports serve Asti. Genova is closest (1 hour by car) and being on the Mediterranean Sea does not suffer from fog which may be common in winter. The other airports are about 95 minutes distant by car. To the east is Milan which has two airports, Linate and Malpensa. To the west is Torino's Caselle airport. From the west (ie Torino) exit the A21 motorway at Asti Est and proceed east on the main road to Castello Di Annone. From the other airports exit at Felizzano and take the main road west. From Castello Di Annone follow the road south to Rocca d'Arazzo. You can also take a taxi from Genova or Torino airports to the town centre and then a direct train to Asti station.

Villa Riccardi's fax and telephone number are +39-141-408565

Nuclear Golf Balls?

This news note was posted to the normally barren Sci.phys.fusion forum:

Ottawa—Avid golfers like PM Jean Chretien are hitting the greens with atomic golf balls. The federally run Atomic Energy of Canada is charging $30.00 for a dozen golf balls irradiated with 10 million volts by using an electron-beam accelerator. The electron beam appears to alter the molecular structure of golf balls and gives them extra bounce—up to 8% farther than untreated ones.

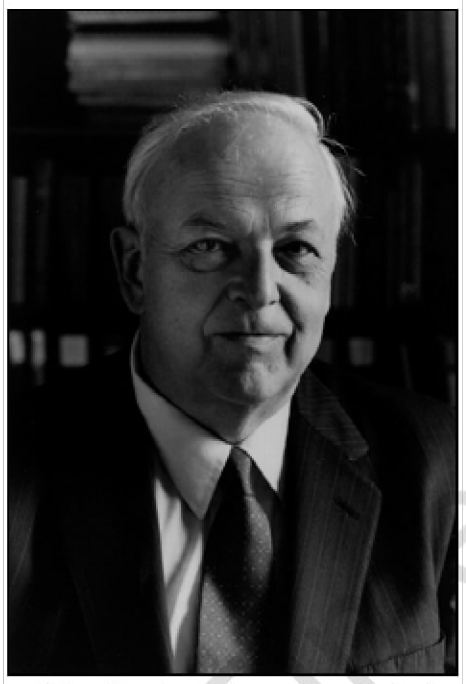
Chretien has used the gamma ray balls, which he also handed out to U.S. President Bill Clinton and other world leaders at the 1996 G-7 summit in Halifax.

Reform MP Chuck Strahl wonders why the taxpayer-funded nuclear institute sells the non-radioactive balls when it should be doing serious scientific research.

"They've probably spent hundreds of million of dollars on the site and what they're most noted for is selling nuclear-powered golf balls." Strahl said. "It's a little wasteful."

[Our Canadian readers should immediately petition to have the Nuclear Golf Ball funding turned over to cold fusion research!—EFM]

Nobel Laureate Burton Richter of SLAC Tries to Kill Cold Fusion Support in Italy



Even as Italian cold fusion work continues to move forward robustly (witness the foredescribed Asti conference, occurring late this November, and the paper on laser transmutation from the University of Lecce in this issue of *Infinite Energy*), Nobel laureate physicist Burton Richter of the Stanford Linear Accelerator Center has written to the Italian INFN:

"The cold fusion work still pursued at LNF and Torino seem to be unscientific relics not worth INFN support."

In a June 24, 1997 "Report of the Instituto Nazionale di Fisica Nucleare," the "International Review Committee" chaired by Professor Richter makes that astonishing and unsupported assault against Italian cold fusion work. It is noteworthy that Burton Richter has appeared at *no* cold fusion meetings of record. We wonder whether he has read even a tiny part of the voluminous cold fusion literature—not that unfamiliarity with scientific literature on the frontier has ever stopped late-20th century physicists from ridiculing things of which they have absolutely no concrete knowledge.

Prof. Richter's Review Committee colleagues were: Paul Kienle (Technische Universität München), Graham Ross (Oxford University), and Volker Soergel (Werner-Heisenberg-institut). Richter's letter of behalf of the Review Committee to Professor Luciano Maiani, President of the Istituto Nazionale de Fisica Nucleare in Rome, Italy, begins with this sentence: "I herewith transmit the report of our special committee which was appointed and charged to review the entire INFN program. The review and evaluation took longer than we had initially thought because the breadth of the program, but all of us on the committee found it a very interesting experience." The letter goes on to state, "...we have tried to make it clear in the very beginning how highly we regard the INFN and its program. Italy is recognized by the international scientific community as being one of the leading nations in the world.

The structure of your organization is remarkably effective at bringing out proposals for the most important science and then supporting them properly. Well done."

The letter offers pablum about the importance of addressing the "situation of young scientists"— warning that "serious damage will be done to Italian science, for the best of your young people may leave the country...". The letter notes that "it was necessary to ask a distinguished foreign theorist to join our group to evaluate the theory program. There were other areas where we also did not feel we could go into great depth."

Of course, there was *no depth whatsoever* to the review of cold fusion—just that single ignorant, bigoted sentence in section #6 ("Miscellaneous Experiments") of the main body of the report.

Professor Richter is the Paul Pigott Professor in the Physical Sciences, Stanford University, and Director of the Stanford Linear Accelerator. He received his B.S. from MIT in 1952 and his Ph.D. form MIT in 1956. He won the Nobel Prize in Physics in 1976 and is a member of th National Academy of Sciences (NAS). We presume that Dr. Richter may have absorbed some of his "wisdom" about cold fusion from fellow NAS member Dr. John Huizenga.

N-Motor Researcher Dies

Controversial researcher and inventor, Bruce DePalma, died yesterday (Friday, October 3, 1997) in a hospital in New Zealand. He had been in a coma for several hours after massive internal bleeding.

More details as they come to hand.

Duncan M. Roads
Editor
Nexus Magazine
Australia

www.nenpa.org Free Archive

Latest on Aqua-Fuel
A letter from the Aqua-Fuel Association

Dear Eugene:

We were planning a big media event for the Aqua Fuel Boat, a Licensing Co. is making noises about funding Robert Jaeger's Balanced Piston Valve and a small Aqua Fuel Plant (experimental). The middleman who is in contact with Robert Jaeger and Bill Richardson asked us to put the brakes on the media event. They have stalled and keep putting off the start of the program, Bob Couch who was supposed be a shop foreman became tired, he started his own business of hauling cars and bought a rig. He plans to sell the pontoon boat, he said he wont mind if you do a story on the Aqua Fuel Powered Boat.

He really did a terrific job and with the help of Motorfuelers of Clearwater Florida. For peanuts they converted the Subaru to run on Compressed Natural Gas. Both Jim and Joe Morton are in the video, they both did the emissions on (CNG) and Aqua Fuel. I bought the Aqua Fuel tank and Bob Couch bought the (CNG) tank, Bob couch footed the bill for boat, engine and everything else. Bob made the fuel the hard way and with the small high pressure compressor filled the Aqua Fuel tank to 1,500 psi.

Robert Jaeger, Bob Couch and myself are volunteers of the Aqua Fuel Asso., we are determined to make this fuel gas made from H_2O and carbon go. The carbon underwater arc produced the fuel, the plastic storage bag was filled, the little high pressure compressor filled the Aqua Fuel tank and now the boat is ready for some exposure from the publication that gave us our first big boost up the ladder. We are showing "FUEL FROM WATER IS HERE TODAY."

I am mailing a copy of "Hydrogen Today", Sherwin Berger's story is telling the hydrogen story and who is behind keeping this from the American public and the world. I have tried to get the American Hydrogen Association to do a story on the carbon underwater arc method of fuel gas production— so far no luck.

We are hoping *Infinite Energy* will do a story on the Aqua Fuel powered boat. As of today there is fuel in the Aqua Fuel tank and the Subaru Engine is all ready to run. We are asking you, Eugene, to help us put fuel from water today where it belongs, in front of your readers here and abroad. Will you help??

My friends in England are asking me when will we run our boat on Aqua Fuel??

The young English student will attend Imperial College of Science and Technology in London this Fall. He will be a valuable member of he new energy age in the near future. He is in touch with some of England's top scientists.

Thank you!

Joe Bollent

AquaFuel Association

PROMOTING ULTRA-LOW EMISSION FUEL MADE ECONOMICALLY FROM WATER & CARBON

Joseph E. Bollent
3126 Kensington Avenue,
Tampa, Florida 33629 USA
Phone 313-37-0214

Bob Couch RLCOUCH1@aol.com
Robert Jaeger RAJ @aol.com

The Cost of Oil Dependency Has been Paid for with Many Lives

Joe Bollent's Letter to a Florida Newspaper:

The documentary on PBS Channel 3 that aired Jan. 23, "A Wing and a Prayer," was the story of the strike against the Ploesti Oil Fields in Nazi-occupied Romania during World War II. It presented a graphic illustration of the struggle for domination through possession of oil.

In an all-American effort to knock out Germany's ability to continue to invade other European countries, a large fleet of B-24 heavy bombers attempted a dangerous low-level attack to destroy the oil fields.

The mission was partially effective and wreaked severe damage on the oil fields. The losses to men and aircraft were also painfully heavy. Many brave Americans became heroes that day.

One attack, one incident, in one long war that seems never to end.

Desert Storm, the most recent war for oil, was one that we all watched on television—one in which both young and old suffered as we watched day and night. We must add up the cost and charge it to the price we pay for our precious energy, energy that is not secure.

Our planet is overflowing in energy-rich recyclable hydrogen fuel. Scientists all over the globe are working on this knowledge, and power is being produced; engines are being operated with immaculate emissions. It is commonly known as the "forever fuel" in the science community and among those working in this field. The question is: Who will tell the people? Who will tell the children?

You can find out more by writing the International Association for Hydrogen Energy, Clean Energy Research Institute, College of Engineering, P.O. Box 248294, Coral Gables, Fla., 33124-0622.

JOSEPH E. BOLLENT
Tampa, Florida

The writer is a retired master sergeant from the U S. Air Force and was a member of the 97th Bombardment Group, 341st Squadron, stationed in England, North Africa and Italy during World War 11.

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NEW-ENERGY SOURCES FOR THE NEAR FUTURE

An Open Letter to Decision Makers

By Hal Fox, Editor of the *Journal of New Energy*

LOW-ENERGY NUCLEAR REACTIONS

During the past three years, at least thirty laboratories from various parts of the world have discovered various methods by which low-energy nuclear reactions are produced. Previously, scientists have worked on and could explain high-energy nuclear reactions, such as in the core of nuclear fission power plants, from the use of high-energy particle beams, and from **hot fusion** systems such as a Tokamak. All of these nuclear processes are defined as being **high-energy** nuclear reactions.

Low-energy nuclear reactions are produced and controlled by low-energy means. For example, certain types of systems used to load hydrogen isotopes into selected metals have been shown to produce nuclear reactions. Voltages under 100 volts are used. Other systems produce high-density charge clusters (clusters of predominantly electrons) and produce nuclear reactions on target metals. Voltages ranging from 100 to 2,000 volts are used to create the charge clusters. These voltages are considered **low-energy** when compared to the million volts or higher used in particle accelerators or compared with the high temperatures used in various forms of plasma physics (such as in the Tokamak). Most scientists do not, as yet, accept the fact that nuclear reactions can be initiated and controlled using low energies.

COMMERCIAL COMPANIES WITH NEW-ENERGY PRODUCTS

The experimental work initiated by Professors Pons and Fleischmann, first in the U.S. and for several years in France (with Japanese funding), has engendered the following subsequent discoveries and developments:

- **BlackLight Power** in Pennsylvania is developing an improved technology by which hydrogen gas, a catalyst, and nickel metal are used to produce high-temperature thermal power. The shares in this company have gone from $0.75 to $1,200 per share. At least two electrical power utility companies have invested in this company.

- **Jet Technology** in Massachusetts offers low-energy nuclear reaction systems using light water and specially-prepared nickel electrodes that produce from 300% to 700% more energy out than energy input.

- Piantelli, an Italian inventor, has patented a device using special electromagnetic features, hydrogen gas, and selected alloys to provide a high temperature, thermal energy source. His work is being funded by Fiat, the Italian automotive company.

- James Patterson [at Clean Energy Technologies], of Sarasota, Florida, has several patents issued on a simple system that produces complex nuclear reactions and is now being marketed for initial laboratory studies. In his laboratory, Patterson is working on the development of a kilowatt unit (now operating for several months) in which excess thermal energy is produced continually.

- **ENECO** (located at the University of Utah Research Park) has recently announced a new invention which is expected to be developed into commercial thermal power units.

- **The Cincinnati Group** has invented, developed, and is now offering its LENT-1 (Low-Energy Nuclear Transmutation) Kit **with a money back guarantee that the user can produce nuclear reactions if the directions are precisely followed.**

- **Trenergy, Inc.** (located at the University of Utah Research Park) has contracted to manufacture special power supplies for the LENT-1 Kit and has replicated and extended the low-energy nuclear reaction results claimed by the Cincinnati Group.

The above list is a sample of the many companies that are involved, world-wide, in the development and commercialization of new-energy devices. Scientists from each of these companies have presented papers about their work at scientific conferences and/or prepared papers for peer-reviewed scientific journals. Some of such technical papers, reporting on successful results, have come from scientists working in U.S. National Laboratories funded through the DOE.

U.S. GOVERNMENT RECOGNITION OF NEW ENERGY

Officials of the Department of Energy are advised by professional advisory panels, boards, or committees. Such advisors are most often selected from universities being supported by DOE funds. With the estimated $20 billion previously spent on **hot fusion** projects, DOE advisors are most often selected from this hot fusion community of scholars. This incestuous relationship of **"you fund us and we will advise you who to fund,"** has resulted in the official denial of funds to most of the new-energy developments. A university professor who has been supported by a multi-million dollar **hot fusion** contract and who becomes an advisor to DOE is unlikely to advise the government to fund a competitive low-energy technology. There would be very strong university pressure to continue in the development of **hot fusion!** This combination of federal funds, appointment to advisory groups, and the pressures for institutional funds on the advisors, has resulted in scientists becoming lobbyist with the following results:

- The Office of Patents and Trademarks has been advised not to allow patents on competitive technology to hot fusion.

- Leaders of some professional societies (such as the American Physical Society) have lobbied to prevent major peer-reviewed journals from publishing articles about competing technologies.

- Officials in Washington, without giving names or affiliations, have called heads of physics and chemistry departments in many major U.S. universities with the message: "If you have so much as a graduate student working on cold fusion, you will receive **no funds from Washington!**"

- Some grant funds, previously open to many varied technical approaches, have specifically listed certain energy technologies as being unacceptable for funding.

- In one case, a DOE official had his funds taken away and was transferred to another DOE office **because he stated that he had funds for well-conceived proposals for projects competitive to hot fusion.**

The strategy by opponents of low-energy nuclear reactions has been effective. By denying patents, denying government funds, denying the ability to publish in major journals, and having an official policy of the DOE that certain energy technologies do not function, new energy developments have been stopped or curtailed. There is almost no support by either large American corporations or by major U.S. universities for research and development of low-energy nuclear reaction technology. The campaign against low-energy nuclear reaction technology has been effective but has not totally stopped research and development activities in the United States.

PARADIGM SHIFT

There is also the problem of **paradigm**

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shift—the process of giving up old and cherished scientific models and developing new models to explain new discoveries. It is easier to deny new discoveries. This denial of the new has plagued inventors and scientists such as Edison, the Wright brothers, Goddard and his rockets, Fermi and atomic energy, etc. However, light bulbs light; airplanes fly; rocket ships go to planets; and atomic energy creates both bombs and power plants. **Similarly, scientific truth can only be fought, not destroyed.** Low energy nuclear reactions survive now and will flourish later.

The revolution in controllable nuclear transmutation has begun. One of the most important developments (electron clusters used in plasma-injected transmutation) has progressed without government funds. Only three privately-funded, small companies have been involved in the technology of plasma-injected transmutation (PIT).

The PIT process provides for making highly-dynamic charge clusters of electrons (about 100 billion electrons in a micron-sized toroid); attaching positive ions (about 1 ion for every 100,000 to one million electrons); accelerating the combined cluster in an electric field; and impacting the cluster onto selected targets. The process can be accomplished in low pressure gases, at atmospheric pressures, and in certain liquids using special electrodes. All three processes can produce controlled nuclear reactions.

Selecting various parameters (energy of charge cluster, type of positive ion, accelerating potential, target material, etc.), it has been shown that this new-energy technology can provide the following four processes:

1. The eradication of radioactivity of high-level radioactive wastes.
2. The development of clean, inexpensive, essentially unlimited thermal energy.
3. The production of some scarce elements from plentiful elements.
4. The design and construction of table-top particle accelerators.

The least-known part of this technology is the production of charge clusters. However, five patents have issued for various embodiments of high-density charge cluster technology and at least three more are pending. Given the fact that a typical charge cluster of about 1 micron diameter can be produced, and that it can be surrounded with a positive-ion plasma, the rest is classical physics and should not be anathema to yesterday's scientists. The dynamics of the charge cluster provide the stability of the combined charge cluster (micro-mini ball lightning). The relatively small number of positive ions (1 per million electrons) means that the combined charge cluster can be accelerated almost the same as the electrons in a TV tube. Thus, a 5,000 volt potential can accelerate a combined charge cluster to about 0.1 speed of light. Protons, deuterons, or alpha particles accelerated to this velocity produce nuclear reactions on target metals (this is standard, classical physics).

By bombarding radioactive nuclei with such charge clusters, the induced nuclear reactions (primarily fissioning of the heavier elements) result in a reduction (with proper engineering, complete eradication is possible) of harmful radiation. Laboratory experiments show a dramatic reduction of, for example, thorium with relatively short-lived increases in alpha, beta, and gamma emissions (no neutrons detected above background). The end result is the transmutation of radioactive thorium into smaller-mass elements with the marked reduction of the naturally radioactive thorium. **It is believed that this technology can be developed to eradicate the radioactivity in a variety of high-level radioactive wastes, including spent fuel pellets from commercial nuclear power plants.**

This new technology is expected to have an enormous impact on the handling of high-level radioactive wastes. An amount of $250 billion has been estimated by DOE officials for cleaning up over 150 weapons-related sites in various parts of the U.S. An estimated $50 billion will be required to clean up the Hanford Site near Richland, Washington. Another $9 billion is estimated to clean up the Idaho Nuclear Engineering and Environmental site. **This new plasma-injected transmutation technology should be able to reduce these cleanup costs by billions of dollars.** Every kilogram of radioactive elements, fissioned into stable elements, would result in saving the current estimated costs of geologic storage of $2,500 per kilogram per year for over 10,000 years! Is there any other technology that has the potential of such an enormous return on investment for a few million dollars of development funds?

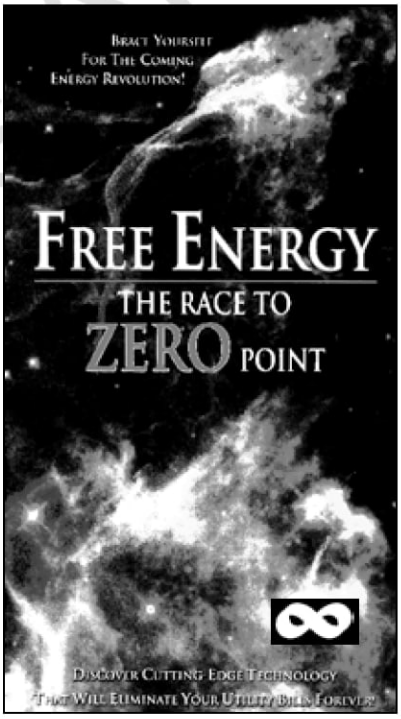
Our government spends billions of dollars on perceived threats to the security of this country and most of these threats never happen. The combined threats of global warming; polluted atmosphere from power plants and transportation vehicles; and a gradual decrease in the vitality of our biosphere **are real, contemporary, and dangerous to our country and the world.** Is it not reasonable that we should spend a small amount of government funds on a new technology that is already **demonstrated to be a potential solution to this real threat?**

FREE ENERGY: THE RACE TO ZERO POINT

THE FIRST DOCUMENTARY ON PROGRESS IN FREE ENERGY

Thomas Valone, M.A., P.E.*
Professional Engineer, Retired College Teacher

Integrity Research Institute, 1422 K St. NW, Suite 204, Washington, DC 20005



ABSTRACT

For the first time, the "free energy" movement has been documented. Also called "non-conventional" energy (coined by George Hathaway in 1981) and recently "new" energy (by the Academy for New Energy), the type of energy that is free to use, without "usage" cost or "utility" cost, is a dream that is held by millions of people. Most still don't believe it is possible. That is why this film was made: to convince the public that free energy is real and the generators exist.

INTRODUCTION

In 1994, I was fortunate to attend a conference in Nevada where I met Brenda Roberts, the host of a Seattle cable TV series called *Journey*. When we talked

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about the energy researchers she had interviewed on her TV show, I asked her about doing a "Free Energy Movie," which would bring together some of the most notable inventors who are literally shaping our future. She liked the idea, and immediately began to work on a treatment of the project. Our proposal was circulated to a few investors but it was not until I attended another conference a year later at Mt. Shasta, that I met Christopher Toussaint from **Lightworks Audio & Video** (Los Angeles, CA) who liked our idea. Chris had been considering a similar video as well and we realized that the time had finally come when this documentary would materialize.

To step back, I'd like to emphasize that ever since 1980, when I spoke at the *Gravity Field Energy* conference in Germany, people were always giving verbal support to the concept of a "Free Energy Movie." The inventors we discovered at these conferences were scientifically interesting and deserved a wider audience. Many of these people were highlighted for my presentation at the *New Energy Symposium* (Denver, 1996), people like Moray, Tesla, Thornson, T.T. Brown, etc. However, as several film makers investigated the possibility of a film over the years and gave up confused and bewildered, the hope for a documentary became less likely. Not until 1997 has a free energy documentary emerged which not only is the first ever such movie but also is a quality production worthy of the description, "enlightening and provocative."

I was fortunate to be selected to be the Technical Consultant for the project and over the past year, we had several rewrites of Chris's basic script. His understanding of basic physics and science is excellent, so even complex subjects, like the "quantum vacuum flux," are described in simple terms that anyone can understand.

Free energy, in its most basic sense, as the narrator Bill Jenkins emphasizes, is energy that is "free as the air we breathe." Bill Jenkins, by the way, is a very entertaining spokesperson who keeps the viewer's interest.

The following serves as a review or summary of **Free Energy: The Race to Zero Point**, the first full-length (2-hour) documentary film ever produced. The paragraph headings are taken from the titles sections of the movie.

THE PIONEERS

Historical glimpses of Tesla, Faraday, and Maxwell introduce the concept of a rotating disk dynamo, which is followed up with today's pioneers like Tewari and DePalma. (Information about these homopolar generators is summarized in my book, *The Homopolar Handbook: A Definitive Guide to Faraday Disk and N-Machine Technologies*, available from Integrity Research Institute, 800-295-7674.) Explanations of Maxwell's theories and zero point energy are briefly described by Tom Bearden, along with a surprising special effect of equations running across the screen while he speaks! The material ether theories, the Michelson-Morley experiment, and the present understanding of the quantum energy flux are clearly summarized by historical video segments of Einstein, computer graphics, as well as words from Moray King and Brian O'Leary.

One of the historical heroes of free energy, whose work has been replicated by present-day inventors, Paul Brown (Patent #4,835,433) and Dr. John Moreland, is T. Henry Moray. A new appreciation for his life's work and trials comes from the richly illustrated summary that is given in this video. Not surprisingly, the persecution that Moray suffered during his lifetime has been also experienced by Brown and Moreland once they started to go public with their discovery. Fifty kilowatts of free energy is too threatening even today. Figure 1 shows a copy of Paul Brown's letter, made public at the *Intersociety Energy Conversion Engineering Conference* in Boston in 1993.

Victor Schauberger's and Walter Russell's lives are also given a succinct biography in this free energy film. We can appreciate their work much better in a visual documentary.

ELECTROSTATICS AND ELECTROGRAVITICS

The historical mysteries of electrostatics and electrostatic motors may not be familiar to many people. The **"Free Energy: The Race to Zero Point"** documentary demonstrates the power of atmospheric electricity. From the original Ben Franklin invention to the modern Jefimenko 1/10 hp motor, and the Swiss M-L Converter closeup footage, the film lays an important groundwork for the argument that free energy motors can include tapping electricity from the air.

Even more exciting is the electrogravity section, which not only introduces T. Townsend Brown in a cold war context but also claims that he "took high voltage to the next extreme." Including the now famous "home movie" of the Brown Bahnson laboratory experiments, Brown's electrogravitics patented levitating disks come alive. The narrator makes note that no one has been successful in replicating Brown's work until recently when Larry Davenport, as shown at a recent *International Tesla Symposium*, carefully built the tapered-edge saucer merry-go-round seen in one of the first Brown patents (US Pat. #2,949,550). The recent findings that the B-2 Bomber has the necessary characteristics for electrogravitic propulsion is nicely shown. An article from *Aviation Week & Space Technology* (March 9, 1992) emphasizes this finding, since the charging of the wings is disclosed. The article title is "Black World Engineers, Scientists Encourage Using Highly Classified Technology for Civil Applications." (Information about this article can also be found in the book Electrogravitic Systems, Reports on a New Propulsion Methodology, ed. by Thomas Valone, published by Integrity Research Institute.)

Why have scientists told us that free energy is impossible? Answers like, "There is no such thing as a free lunch" and "Perpetual motion is a violation of the second law of thermodynamics" are presented against the explanations, such as Tom Bearden's, that in open systems, the output may seem to exceed the input. Moray King's explanation of the zero point energy, being the basis of string theory, is emotional. My answer is, "Therefore what seems to be nothing will actually be understood to be a field effect, a tapping of energy that can't be seen." Following that, I draw the analogy to a primitive tribe seeing a TV set for the first time, converting invisible radio waves into pictures. Bearden emphasizes that working free energy devices should be viewed as no more mysterious than a windmill or paddlewheel which converts available energy in an open system into usable force. Dr. Brian O'Leary then extrapolates these ideas to the ether and consciousness which he feels are also associated with free energy.

INERTIAL PROPULSION

With the introduction from Dr. Hal Puthoff that inertia is an interaction with the zero point fluctuations of the vacuum, inertial propulsion is linked into the theme of the film. Canadian inventor Roy Thornson's device is featured powering a canoe across a swimming pool, with the motor never contacting the water nor the air. His patented (US Pat. #4,631,971) inertial propulsion drive achieves 20 times the efficiency of a jet engine. A DC-9 produces 0.016 N/W (3 lb/hp) to achieve forward momentum but Thornson's produces 0.32 N/W (60 lb/hp) while doing it. Therefore it's been found to be twenty times more powerful than the jet engine for the same energy input. However, the film notes that he has still been unable to attract sufficient capital to bring his invention to market.

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PLASMA: CONTROLLED LIGHTNING

Starting with the plasma lightning bulb as an illustration, the Correa pulsed plasma invention leads us to the suggestion that Paul Pantone's GEET device is also a plasma reactor. Pantone's engine is shown in the film to emit no soot or carbon-based exhaust and to power a car. Pantone receives a short review by Dr. Gene Mallove, editor of *Infinite Energy* magazine, as well as endorsements from foreign customers. (A great magazine for information on free energy and cold fusion inventions, *Infinite Energy* is available from P.O. Box 2816, Concord, NH 03302.) Interestingly, Pantone is shown fulfilling orders for his converted motors, thus making the point that at least this device is on the market.

Figure 1:
Nuclear Battery inventor Paul Brown explains leaving commercialization behind.

November 1, 1991

Paul Brown
c/o: PO Box 201
Los Altos, CA 94023

Greetings,

I have been involved with alternate energy since 1978, while still a college student. Over the years I have heard many nightmare stories about people who developed something significant only to be persecuted, harassed, prosecuted, and even killed. I was sure that these stories were exaggerated or possibly the result of the inventor's own paranoia or such. Further, I met several inventors whom I felt were their own worst enemies (via fabrications of their imaginations) which confirmed my beliefs.

As time went on and in about 1982, I became involved in work of some significance and received some minor criticism and skepticism that I found to be beneficial as well as practical, but no death threats or any of the other forms of persecution. I built experimental devices, learned things unavailable from books, filed for patents and in general felt very satisfied with my life, society, and the scientific system.

However, things began to change slowly and alarmingly. The more success I had in my endeavors—the more I began to attract dishonest and greedy people (I know this now but was unaware of it then). My life became more uncomfortable as time went on but I was not sure of the problem.

In 1987 we decided it was time to let the world know what we were working on and the results we were getting. It was a proud time for me. I thought we were doing the right thing. But this was the real beginning of the worst.

Since that February 1987 I or my company have been persecuted by the State Dept. of Health; then the Idaho Dept. of Finance filed a civil complaint against the company and myself; my license for handling radioactive materials was then suspended for 6 months; I began to receive threats (i.e., "We will bulldoze your home with your family in it."); securities fraud charges were then filed against my company and myself; then investigation by the Oregon Dept. of Finance; then the tax man; then the Securities and Exchange Commission; my wife was assaulted; I lost control of my company; my home has been robbed three times and vandalized on four other occasions; twice now I have been accused of drug manufacturing; I lost my home; most recently my mother's car was pipe bombed. With each hardship I strive harder toward successful development of the technologies under my endeavor. But it only seems to get worse.

Someone once said, "Paranoia is only a sense of heightened sense of awareness." He was right! It is hard for the average guy to comprehend these disasters happening to select people. I am here to tell you it is not coincidence. I now understand why some inventors drop out from society.

My advice to you is to keep a low profile until you have completed your endeavor; be selective in choosing your business partners; protect yourself and your family; know that the nightmare stories are true.

God speed, Good Luck in your endeavors, and Never lose The Faith.

Sincerely,

Paul Brown

COLD FUSION: HYDROGEN POWER

The truth about cold fusion is dramatically stated by prominent physicists like Dr. Dennis Cravens, Dr. Eugene Mallove, and Hal Fox. The best example is illustrated with company-provided graphics of the Patterson Powercell operation, which electrolyzes water. The Patterson cell also produces hydrogen and oxygen as a byproduct of its prodigious heat emission (1 kW of heat for several days). It is mentioned in passing that the mining of palladium may have a bearing on the growth of the cold fusion industry.

Dr. Mallove asks the pregnant question, "When we have generators of heat and electricity that can stay in the home or building, why would anyone want to be connected to the power grid if you are plugged into a self-contained power unit at home?" He points out that power utility companies are now sending representatives to cold fusion conferences showing the fact that they are preparing to adapt to a changing market. Low energy processes may soon be the source of heat and electricity for homes and businesses.

Hal Fox, editor of *Journal of New Energy*, describes the method by which he predicts that we will soon be making nuclear waste non-radioactive.

TODAY'S PLANETARY CONSCIOUS INVENTORS

Mississippi inventor Joe Newman, who has been denied a patent even after scientific affidavit and demonstration to the U. S. Patent Office, is featured at length. He describes the details of how energy in a magnetic field consists of gyroscopic particles and then demonstrates a few of his generators at work.

Energy Research Corporation is next featuring microprocessor-controlled permanent magnet motors which maximize flux density of the magnets. David Porter from Galtech Semiconductors has just received a patent for his carousel electric generator (#5,625,241 on 4-29-97) which pulses coils on the stator while the permanent magnet rotor floats on magnetic bearings, turning at 2000 RPM or greater. It acts as a flywheel for inertial energy storage too. Some of these magnetic motors try to use Lenz' Law to their advantage (the rebound from energizing a coil). Porter states that he believes the excess energy he is measuring comes from the magnetic field of the magnet.

The Troy Reed demonstration of his magnetic motor, disconnecting the starting power, is impressive as a test of self-sustaining energy. However even more impressive is when he lifts the hood on his "Surge" electric car. We can see that only the electric motor and a small car battery is there. The battery, he claims, is used to power the blower and the radio. Surprisingly, the Curtis controller box stays cold even during the operation of the car on a highway, which implies that the amperage stays very low. This car operates at 120 V with 100 amps or less.

Dennis Lee of Better World Technology demonstrates, with a super efficient heat pump, heat drawn from the surrounding air with a refrigerant which boils at 40 degrees below zero. It achieves a very high coefficient of performance combined with the super efficient heat engine of Dr. Fisher. His heat pump system can supply all of the heat and some electricity needs for a medium size home without electricity from the utility grid. I saw Dennis Lee ten years ago in California and feel that his heat pump invention deserves admiration. Even the State of California had so much respect for the impact his invention would make that they imprisoned him without a trial for two years. Many articles were written publicizing his situation during his imprisonment.

BEYOND THIS DIMENSION

The side effects from over unity devices can include transmutation of metals, the creation of new isotopes, and even antigravity, as mentioned in this film. A levitating spinning top, is shown to float in mid-air repelling a powerful magnet, analogous to the greater antigravity effects seen with the Searl device and the Hutchison effect.

John Hutchison is interviewed, demonstrates his new amalgamated battery, and moves objects with self-resonating electromagnetic fields. The crystal energy converter which he now is promoting is a curious battery that reminds us of T. Townsend Brown's petrovoltaic (rock voltage) research.

Shown up close is a letter from the U. S. Department of the Army in 1991 which declares that the *report on his work is classified*. However, it states that Hutchison's

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work "holds merits in future developments." The amazing point about the Hutchison effect, besides all of the objects which disintegrate or even reintegrate, is that the energy input has been analyzed by professional engineer George Hathaway to be inadequate to lift some of the heavier objects seen on film. Now, if there is any doubt about this unprecedented electrogravitic anomaly, the public is allowed to see, for the first time, the electromagnetic levitation of a 70 lb. cannon ball! This electrogravity has been shown to create *hyperforce*, a third order effect, which causes a uniformly increasing acceleration. Engineer George Hathaway is responsible for this analysis which is recorded in the *Proc. of the Third Inter. Symp. on Non-Conventional Energy*, 1983 (published by PACE, 100 Bronson #1001, Ottawa, Ontario).

Finishing off this section, we see quotes from Hutchison, Moray King, and Beardon warning us about using the new forms energy responsibly. The consequences of misusing the inventions are also explored.

PARADIGM SHIFT HAPPENS

The last section of the video explores details about funding of free energy inventors. It is noted that Japan is much more enthusiastic about this research. This has been demonstrated by the large cold fusion funding capital. Dr. Inomata points out that the unseen energy comes from the other dimension. Bearden points out that theoretical modeling is necessary for commercialization of the new devices now being demonstrated. Orthodox science is creating roadblocks to the utilization of the free energy. He points out that the oil industry can still find a market in the manufacture of materials which are made from petroleum. He also mentions that they have stopped killing the inventors only recently. He predicts that funding of the upscaling process will occur soon, helping graduate students to contribute to it with their thesis research.

Hal Fox predicts that the spinoffs of free energy and cold fusion research will be seen in magnetism, nuclear waste disposal, motor development, battery technology, space propulsion, antigravity, and in the production of scarce elements from plentiful elements. We are told that the door is opening to a new millennium of science. Brian O'Leary says we will be free when energy is free, making us free to express ourselves. Gene Mallove says no aspect of human culture will be untouched by this revolution in cold fusion and free energy. The fact that water is the source of cold fusion energy will abolish air pollution. He states that space travel will be transformed, something he has looked forward to. Jean Manning, author of *The Coming Energy Revolution*, says that utilities will have to address the changeover to clean energy sources. Moray King asks is if this like giving matches to a baby or can we transform ourselves into the awareness that we are planetary beings.

Pivotal crisis...fears of the past... transforming skepticism to open-mindedness...soon to affect all of our lives...the race is on! Nikola Tesla says, "Now as never before is the time ripe for the development of new resources." Just one invention with "over-unity" output signifies that we have succeeded. This video achieves a milestone by showing us the future.

CONCLUSION

On Jan. 21, 1997, *The N.Y. Times* announced that for the first time ever, "Physicists Confirm Power of Nothing, Measuring Force of Quantum 'Foam'." Dr. Lamoreaux of Los Alamos Labs experimentally determined the Casimir force thus verifying zero point energy (ZPE). Only a month earlier, Dr. Frank Mead obtained the first ZPE patent (#5,590,531) on 12-31-96. These two synchronistic events prove that this film is critically timed for raising public awareness of the energy revolution. "Free Energy and Propulsion," from Integrity Research Institute ($5), references many of the inventors in the movie. The VHS video, *Free Energy: The Race to Zero Point* is available from Integrity Research Institute (800-295-7674) for $34 & $2 P+H. Requests are also invited for a free publications catalog by phone, fax (301-513-5728) or email (iri@erols.com).

[EDITOR's NOTE: "Free Energy: The Race to Zero Point" video tape is also available through* Infinite Energy *magazine—see the ad on the inside back cover of this issue.—EFM]

Propulsion Continued from page 75

consisting of zero-point radiation impinging on accelerated objects as viewed by an inertial observer, suggests that the resistance to acceleration attributed to inertia may be a force of opposition originating from the vacuum.

(8) Bernhard Haisch, Lockheed Palo Alto CA: "Implications of an Electromagnetic Quantum Vacuum Basis for inertia" (20 min.)
The "Inertia as a Zero Point Field Lorentz Force" concept published in 1994 by Haisch, Rueda and Puthoff proposed that the Newtonian F=ma equation of motion could be derived from Maxwell's equations as applied to the electromagnetic quantum vacuum. A relativistic version of this concept has been developed. This suggests that the momentum of the quantum vacuum may be a possible basis of propulsion. On the other hand the existence of "negative mass" as hypothesized by Bondi is ruled out.

(9) Daniel C. Cole, IBM Microelectronics, Essex Junction, VT: "Calculations on Electromagnetic Zero-Point Contributions to Mass & Perspectives" (20 min.)
Results will be described for the calculated reaction force due to classical electromagnetic zero-point radiation acting on a classical electric dipole simple harmonic oscillator uniformly accelerated through the vacuum. The results of this work will then be related to other scientists' proposals for the possible relationship of zero-point radiation to inertial mass and gravitational attraction.

(10) Peter W. Milonni, Los Alamos National Labs, Los Alamos NM: "Casimir Effect: Experimental Evidence and Implications" (30 min.)
Casimir effects will be briefly reviewed with emphasis on different ways of explaining them: vacuum field source fields, and macroscopic manifestations of intermolecular forces. A "superluminal" feature that appea rs in the relativistic theory will be discussed and argued to be unobservable. Scientific and technologic implications of Casimir effects will be addressed as time permits.

(11) Hüseyin Yilmaz, Electro-Optics Technology Center, Winchester, MA: "The New Theory of Gravitation and the Fifth Test" (30 min.)
The two theories of gravity, by Einstein and Yilmaz, will be compared side-by-side. It will be shown how failure to include gravitational stress-energy blocks the general N-body solution for the space-time metric. The gravitational perturbations on Mercury by the other planets will be discussed; a "fifth test" of gravity theories. It will be shown how Einstein's theory fails the test and the Yilmaz theory passes the test. Some mention shall be made about binary pulsars and the Yilmaz Theory.

(12) Warner A. Miller, Los Alamos National Labs, Los Alamos, NM: "Hyper-Fast Interstellar Travel via a Modification of Spacetime Geometry" (30 min.)
The authors will outline and unify the two proposed methods for hyper-fast interstellar travel (the Alcubierre warp bubble and the Krasnikov tube). The authors will address key features and obstacles confronting these proposals, including the casual structure, weak and null-energy conditions, as well as the violation of chronology protection. These obstacles give rise to new avenues involving gravity quantization.

(13) Frank J. Tipler, III, Tulane University, New Orleans, LA: "Ultrarelativistic Rockets & the Ultimate Future of the Universe" (30 min.)
Traversing cosmological scale distances will require ultrarelativistic rockets, i.e. rockets for which gamma >>1. The author outlines the theory of high gamma rockets, showing that (1) the expansion of the universe can be used to slow the rocket, thus dramatically reducing the initial mass ratio; (2) with current technology, proton-antiproton annihilation is the favored rocket mechanism; (3) the Standard Model of particle physics allows baryon number conservation to be violated, making it easier to manufacture antiprotons; (4) payloads will probably weight less than a kilogram, because virtual humans will be the only humans ever to engage in interstellar travel; (5) constraints imposed by the ultimate future of the universe must be taken into account in any analysis of interstellar travel.

(14) George Miley, University of Illinois, Urbana IL: "Overview of Empirical Evidence Related to Claims of Anomalous Energy Effects " (30 min.)
A variety of effects involving excess energy, radiation emission, and transmutations have been reported experiments involving lattices loaded with deuterium by various methods. The scientific community remains divided in opinion on the validity of these effects. However, if true, this opens a "breakthrough" in science and a potential new source of space power. The presentation will briefly review these past results, but concentrate on recent experimental and theoretical work including an interpretation in terms of nuclear reactions.

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THE BAUXITE-ALUMINUM INDUSTRY AND THE IMPACT OF COLD FUSION-GENERATED ELECTRICITY ON ITS PRODUCERS AND SUPPLIERS.

By Cheryl A. Townsend, Nova Resources Group, Denver, Colorado

Introduction

From the automobiles we drive to the canned beverages we enjoy and the barbecue grills we line with foil on Labor Day weekend, each of us is directly affected by the bauxite-aluminum industry.

Bauxite is the ore from which aluminum is recovered. It occurs mainly in tropical regions of the world, with Australia, Guinea, and Jamaica being the world leaders in bauxite production. In any study of the world aluminum industry, it is necessary to focus on factors which determine the location of facilities for converting raw bauxite into finished metal. Present location patterns find the mining of the raw ore occurring mainly within the lesser-developed countries (LDC's) where the ore occurs, while the production and processing of the metal occurs in industrialized countries, where the metal is mainly marketed.

Within the LDC's there is a strong desire to have economic control beyond the extractive stage of production, to encompass as many as possible of the manufacturing operations in producing finished metals. Because certain physical characteristics of the aluminum production process are intensive in their consumption of electricity, LDC's are often unable to accommodate the energy demands. Therefore they are limited to the degree of control over their natural resources. I will discuss the economic and political considerations which feed the desire of the raw-material-producing LDC's to gain this control. I will specifically focus on the import-export market of bauxite-alumina[1] between the US, Canada, and Jamaica. Bauxite in Australia is at a disadvantage in competing for North American markets due to its distant location. Shipping costs of bauxite between Guinea and Australia and the US, when compared to the Caribbean region, are not economically competitive.[2]

The cost of energy will ultimately affect the economic health and future of the bauxite industry and bauxite-producing countries, as it will determine the ability of aluminum to remain competitive with other less-energy-intensive metals and materials. Technological advances in the smelting stage[3] of the aluminum-reduction process have eluded scientists for a hundred years, but what if that were to change? What if an energy source were brought to commercialization that was clean, abundant, and renewable? What if bauxite-producing countries found themselves surrounded by oceans of 'fuel'? How would this new technology affect a lesser-developed-country like Jamaica? I will close with a suggested scenario for the impact of a revolutionary energy source, such as cold fusion, on bauxite-producing countries—specifically Jamaica, but also the aluminum industry as a whole.

History

Enormous demand for aluminum as a result of WWII caused a shift in the production patterns in the industry. Up to that time, aluminum was the product of an advanced technology long protected by patents and other devices, and was tightly held by the few firms having access to the technology. Prior to 1940, nearly all of the world's aluminum was produced in the industrial countries of Europe, North America, and Japan (Brubaker 1967). At that time, with the then smaller scale of the industry, bauxite resources in Europe and North America were able to meet the majority of local needs. However, since the late 1940's there has been much investigation into bauxites of the Caribbean, primarily in Jamaica[4] and to a lesser extent, Haiti and the Dominican Republic.

The discovery of laterite[5] deposits in several tropical countries has been the primary reason for this great increase in world bauxite resource estimates. As earlier mentioned, location of the Caribbean with respect to the North American markets has made Jamaica a world player in the industry. The association of aluminum with modern technology and industrial and military strength has spurred the interest of planners in many ambitious LDC's, especially those that have valuable bauxite or hydroelectric power resources. Low-cost hydroelectric power produced by water-development projects, such as government-financed dams, is often sold to aluminum companies at a fraction of the market price of electricity generated by other means. This practice greatly enhances the economic value of such multi-purpose projects, as is seen in many of the American Northwest smelting operations.

The lack of infrastructure and industrial skill within LDC's, coupled with the inability to produce low-cost electricity has typically made countries like Jamaica unfavorable sites for aluminum-reduction (smelting) operations. Poorly informed about important aspects of the bauxite/alumina/aluminum industry, which placed them at a disadvantage in negotiations over the development of the industry, bauxite-producing countries formed the International Bauxite Association (IBA) through which they have acquired a fuller awareness of the structure and operation of the industry.

The IBA was established in March, 1974, with seven members: Australia, Guinea, Jamaica, Guyana, Surinam, Sierra Leone, and Yugoslavia. By November 1975 four new members had joined: the Dominican Republic, Haiti, Ghana, and Indonesia (Woods & Burrows 1980). IBA members produce approximately 60 million tons of bauxite per year (Thomas 1983). The proposal to form a bauxite cartel had existed among these countries, particularly in the Caribbean, for many years prior to 1974.

The success of the Organization of Petroleum Exporting Countries (OPEC) in increasing the price of crude oil by nearly 400% in 1973 (Banks 1979) stimulated the formation of the IBA in two ways. First, it served as a model for the cooperation of suppliers in the pricing of a commodity. Second, the enormous increase in oil prices in 1973 imposed a large economic burden on the major bauxite-producing countries, all of whom import most of their petroleum from members of OPEC. Because of its cost advantage in the US market, and the fact that Jamaica's oil costs tripled in 1974 (Banks 1979), it is no surprise that Jamaica had been the dominant force behind the formation of IBA.

Dissatisfied with the level of taxation, in 1973 Jamaica entered into negotiations with the major aluminum companies to revise the tax rates; agreement could not be reached. In 1974 Jamaica unilaterally increased its export taxes on bauxite by over 800% (Woods & Burrows 1980) as set forth in the Jamaican Bauxite Act. Following Jamaica's tax increase, most of the other IBA members took similar action.

In addition to increasing taxes, many IBA members seek a greater stake in the smelting and refining stages of aluminum production. The Jamaican government, through negotiations with major aluminum companies, has secured an equity interest in existing alumina operations in Jamaica.[6] The government is also encouraging the aluminum companies, via export tax rebates on alumina, to expand their Jamaican alumina capacities so that a larger portion of the bauxite mined in Jamaica will be refined there.[7]

There are basically six major aluminum companies among which the bauxite-aluminum market is distributed, all of which have operations in Jamaica. They are as follows (in no particular order): Kaiser Aluminum and Chemical Company of America, Aluminum Company of America (Alcoa), Reynolds Metals Company of America, Alcan Aluminum, Ltd of Canada, Pechiney Compagnie de Produits Chimique er Electrmetallurgiques of France, and Schweizerisches Aluminum

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A.G. (Alusuisse) of Germany. The Jamaican Bauxite Institute in Kingston was established by these companies and the Jamaican government to facilitate the development of and maintenance of the bauxite industry. Its function is to research and investigate any geological, environmental, and technicological issues concerning the industry in Jamaica. With Jamaica's bauxite total estimated reserves of two billion tons, enough to last for 100 years at current production, the country's demonstrated ability to effect a change in a global market, and its obvious desire to expand into that market, Jamaica is theoretically prepared to move into the processing and manufacturing operations involved in producing a finished metal. At present, however, they are technically unable to produce the required energy to run such operations—or are they? Cold fusion research has been underway for nearly a decade, and experimental results[8] indicate that commercialization of the phenomenon would end concerns over the current world energy demands.

Future Possibilities

In 1989, Drs. Martin Fleischmann and Stanley Pons, electrochemists at the University of Utah, announced that they had achieved "nuclear fusion" at room temperature. This announcement amazed and excited the scientific community like no other claim had since perhaps the elucidation of the structure of DNA by Watson and Crick. The excitement soon turned to frustration and anger as scientist were unable to readily reproduce the cold fusion effects claimed by the Utah group. It was soon realized that nearly all failed attempts were the result of poor loading techniques, which are of paramount importance in cold fusion reactions. By that time, however, the scientific community was sharply divided between those who did believe a valid discovery had been made and those who did not. It was "too good to be true" for most scientists.

It was somewhat like the sweepstakes entry: "Wow, wouldn't that be great! But , you have to enter, look for the little red stamp on a sheet of a thousand, or better yet, fill out a 3X5 card if you don't want to order at this time but would like to enter... and everyone knows that nobody wins those things." Since any lucid physicist would know you "can't overcome the coulombic barrier at room temperature," why bother looking for the little red stamp?

It was best said by the father of classical Field Theory, Michael Faraday, "Nothing is too wonderful to be true." It has been said that the energy content of all of the oil reserves on earth may be equaled by one cubic mile of ocean water if cold fusion can be commercialized. It is not difficult to see how this technology would serve the needs of island countries like Jamaica!

Suppose for a moment that this technology were available and that the Jamaican government has decided to use it to begin aluminum processing operations. An immediate surge in the construction industry would be felt as smelters and power generation facilities were built. At the same time, a demand for skilled labor would generate employment in the education sector that would increase until the infrastructure was in place—as the shift toward production and later manufacturing were to occur. The ability to manufacture products for consumption or export greatly increases the political and economic position of a country. If Jamaica were to construct a foundry operation in which it cast aluminum objects, it could draw-in such industries as automobile and aviation manufacturing. The employment opportunities brought by these industries would change the lives of the average Jamaican. Education would become more accessible as the demand for skilled labor was maintained.

Cold fusion offers Jamaica the opportunity to move forward and become a more-developed-country, while enjoying economic success and a strong sense of pride in the utilization of its main mineral resource. Industry experts in the 60's (i.e. Brubaker et al.) predicted an unpromising prognosis for the development of processing capacity in underdeveloped countries. This was based on many of the concerns already discussed, but in the case of Jamaica also because of limited land area. However, in the past decade there have been numerous examples of offshore barge installation of industrial facilities. Facilities of this type have the added benefit of mobility in the event of a hurricane.[9]

Limited land area can also result in rapid environmental degradation. However, Jamaica has one of the best record of rehabilitation of mined lands in the world. Reynolds and Kaiser have been involved in the very successful establishment of forest, growing vegetation, and raising livestock on mined lands.

Impact on the US

But how does this economic success for Jamaica translate for America? Nearly all of the bauxite and alumina exported to the US from Jamaica is shipped through the Panama canal and up the American west coast to the Columbia River area, where it is ultimately processed. The success of the aluminum industry in this region of the US is at the expense of the environment and other local industries. Damming projects along the Columbia River are responsible for the loss of the salmon industry, in addition to the loss of habitat resulting from mass flooding associated with damming projects. Only in the rare case of Niagara Falls is hydroelectricity benign to the environment. If Jamaica were to "take-up" only this portion of the US refining operations, it would have a sizable processing industry. This may mean a loss of jobs in the American Northwest in the aluminum industry initially. However, in the long run, cold fusion would create industries and markets that are at this time inconceivable.

The PC and the Information Super-Highway are cases in point. Twenty years ago the positions of "Internet" or "web-page" coordinator would have sounded like nonsense. The gradual incorporation of cold fusion-generated electricity into the existing grid and infrastructure would ease the transition from the use of coal to cold fusion, by continuing to utilize existing expertise and skills of the utility companies. The petroleum companies will have slightly more time before they feel the effects of cold fusion, because the existing research in the field is not directed toward private transportation. These changes are global in scope and worthy of further investigation.

References

• Jacob, Leonard Jr., 1984. *Bauxite: Proceedings of the 1984 Bauxite Symposium*, the Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York, 1984.

• Brubaker, Sterling, 1967. *Trends in the World Aluminum Industry*, Johns Hopkins Press, Baltimore, Maryland 21218, 1967.

• Woods, D.W. and Burrows, J.C., 1980. *The World Aluminum-Bauxite Market*, Praeger Publishers, CBS Educational and Professional Publishing, New York, 1980.

• Thomas, Ronald J., 1983. *Role of the I.B.A. in the Bauxite/Alumina/Aluminum Industry*, The Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. New York, 1984.

• Banks, Ferdinand E., 1979. *Bauxite and Aluminum: An Introduction to the Economics of Nonfuel Minerals*, Published by D.C Heath Company, USA and Canada 1979.

Footnotes:

1. *Alumina* is a "second-stage" product of the aluminum-production process that is more economical to export due to the input-output ratio of alumina to aluminum compared to that of bauxite to aluminum. For example, four to five tons of bauxite are required to produce two tons of alumina, and approximately two tons of alumina are required to produce one ton of aluminum.

2. Part of Australia's disadvantage due to geographic location is overcome by its becoming the world leader in alumina production and exporting one ton of alumina instead of 2 - 3 tons of bauxite. This coupled with Australia's coal resources, which enables it to process the bauxite into alumina, accounts for the fact that the US imports nearly half of its alumina from Australia.

3.The smelting stage of the process is the primary energy consumer in aluminum production, and will be discussed in detail later in this paper.

4. In October 1943, Alcan was incorporated under the name Jamaica Bauxites Limited as a Jamaican company to investigate the commercial potential of Jamaican bauxite. *Miami Herald*, Friday, June 13, 1997.

5. Soil scientists regard laterites and lateritic soils as the product of *laterization*, a complex chemical weathering process involving an increase in alumina or iron oxides, or both. Highly ferruginous laterites constitute large iron-ore reserves in tropical countries.

6. Jamalco, owned by the Aluminum Co. of America of Pittsburgh (Alcoa) and the Jamaican government, is one of Jamaicaís leading bauxite refiners, and produces 850,000 metric tons of alumina per year. It has

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Open Letter to ABC Television's John Stossel .....ABC's JUNK JOURNALISM?

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Friday, August 29, 1997

John Stossel
e-mail stossel@abc.com

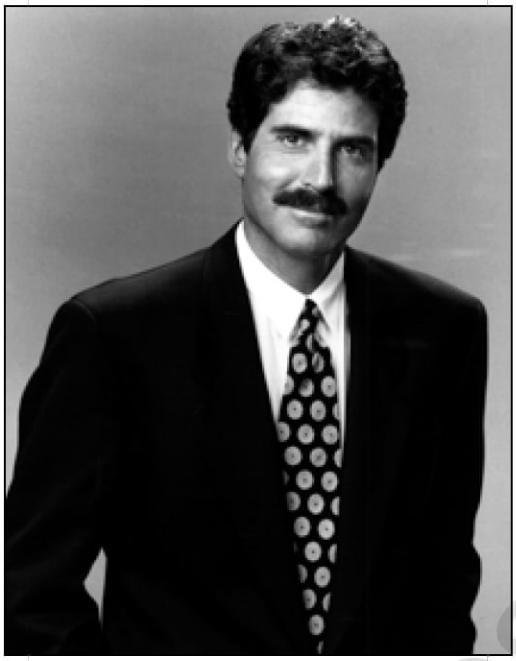
Dear Mr. Stossel:

I have watched your reporting on 20-20 with admiration and respect. However your segment on "cold fusion" during the program "Junk Science," which was recently broadcast for the second time, has caused me to question your competence and integrity. Most viewers have no way to evaluate statements made in the Media — they take much of what is said on faith. That faith can be destroyed by programs that present information known by the viewer to be false. Enough sloppy reporting will damage a reputation beyond repair. Fortunately for you, few people yet know the truth about "cold fusion." Your action is particularly reprehensible because you were given factual information that you ignored in an effort to make a case against junk science. While I agree that "Junk science" is a problem, your cynical use of "cold fusion" as an example produced, instead, an example of Junk Journalism.

My knowledge about "cold fusion" comes from an eight year study of the field starting in April 1989 while working at the Los Alamos Scientific Laboratory. I have personally observed tritium and heat production from Pons-Fleischmann type cells, first at LANL and now in my own laboratory, and I have reviewed the worldwide literature on several occasions. The results of this research and the reviews have appeared in several respected scientific journals. I have also had extensive conversations with both Dr. Pons and Dr. Fleischmann about their attitudes and experiences during the early times. I would view myself as a conventional scientist who remains skeptical until I see the evidence. In my case, I have seen the effect directly, I have determined why others have failed, and I have examined work being done at over a dozen laboratories world-wide.

You gave the following false impressions:

1. That the phenomenon called "cold fusion" is false, being caused by error and sloppy work. Although the phenomenon is still difficult to produce in a predictable way and the quantity of products, both heat and nuclear, are still at very low levels, data obtained in seven countries by at least one hundred scientists which are described in over 500 published papers demonstrate a real phenomenon. In my 40 years as an active scientist, I have never seen conventional science reject a phenomenon so completely in spite of overwhelming evidence to the contrary. Even Galileo had better support. This self-induced blindness is the important issue, not the one you presented. The recent *New York Times* article (Aug. 26) about the closing of the Japanese cold fusion laboratory (NHE) is the most recent distortion of fact about the field.



John Stossel, ABC News.
Photo by Steve Fenn/ABC

2. That Drs. Pons and Fleischmann were blinded by the wish for personal fame. In 1989, these scientists did not want to reveal their work at all because they knew it required much more justification. To obtain money for further work, they sought funds from the DOE. This process alerted Prof. Jones at BYU to their work and started the sad chain of events as described accurately in several books available to you. It was the president of the University of Utah who forced a news conference, over strong objections, in order to attract fame to the U of U rather than to BYU — an event that forced premature publication. Once the claims became known to the scientific and political world, the potentially important implications caused massive attention by scientists and by the press, a completely normal and expected reaction which short-circuited the normal peer-review process. For example, dozens of experiments were started at LANL in an attempt to duplicate the claims. Optimism and excitement were commonplace. Events during this stage were completely independent of P-F. Indeed, their lives became a living Hell. To make matters worse for them, the University lawyers refused to let them reveal what little they knew about how to replicate the results, for patent reasons. As a result, the few positive results came from chance rather than from understanding. In the absence of the required reproducibility and in the absence of an explanation of how such a strange phenomenon is possible, the normal skepticism found in scientists grew until it has now become institutionalized. This means that respected scientists, who you or others might ask about the reality of the claims, have lost interest in the field. As a result, their opinions are no longer based on the current state of knowledge, hence remain unchanged from their initial skeptical conclusions. Thanks to your efforts, these old attitudes are maintained rather than updated. It is ironic that you show Dr. Williams (Harwell) giving his assessment when later, independent analysis of his work showed that his studies did, indeed, make excess energy. He was unwilling to believe his results because the amount of excess heat was small and the skeptics were so powerful.

Your efforts may have a larger and more sinister effect than you intended. The phenomenon is being actively explored in Japan and in Italy, in spite of the scheduled closing of the NHE laboratory. Eventually, these efforts will solve the considerable problems and find ways to make this energy source commercial. A cheap, renewable, pollution-free, and politically uncontrollable energy source would then be available. When this happens, the impact on the US economy will be devastating. Thanks to the skepticism in the US, we will not have scientists who can quickly follow their lead, and we will not have technicians who can bring the work to the marketplace. We will? therefore, be many years behind the other, less arrogant countries. Even a small chance that these predictions might come true should make you worry. I hope in the future you will take more seriously your considerable power to inform.

Sincerely,
Edmund Storms

Note: Concerned *Infinite Energy* readers are urged to contact Mr. Stossel at ABC Television to ask him to correct his program's misinformation on cold fusion. Better yet, ask him to investigate the scandal of the "Junk Science" —i.e. fraud—practiced against cold fusion research by the DOE and its helpers in academia.—EFM

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Beginning a New Section for an old subject that is now being revisited in cold fusion and transmutation laboratories around the world.....

ALCHEMY - THE FIRST GOLD RUSH

by Susan Seddon

The ancient alchemists worked steadfastly towards the attainment of several noble ideals. Through their scientific and philosophical doctrine they hoped, not only to transmute the base metals into gold, but also to discover a universal cure for disease and, thereby, a means of achieving immortality.

An awesome quest.

Ancient astrologers were amongst the first to experiment with alchemical processes. Their own objective of understanding man's relationship to the cosmos and interpreting this knowledge for the betterment of mankind, was clearly in parallel with the higher ideals of alchemy.

Whether it was, in part, due to the astrological connection or otherwise, the chemical processes themselves were generally shrouded in mysticism. The complex mixings and heatings often being carried out at times of positive celestial "effectiveness." Cryptic notes were made of observed reactions and obscure names given to the materials used. If this practice was genuinely esoteric or simply stealthy is unclear.

Certainly, the search for the "stone which is not a stone" as alchemists frequently described the elusive "elixir" was an intense, potentially highly profitable, global pursuit.

In many cultures, gold was synonymous with longevity and the ability to manufacture the precious metal from common materials was believed to be the initial, faltering step on the road to achieving immortality.

The first, officially recognised, alchemist was the Egyptian, Zosimos (c. 300 AD). Many of his writings are preserved, in which he claimed to use a "special formula" to effect transmutation. Subsequently, this formula became widely known in Europe as the "philosopher's stone." Much of his work laid the foundations for future chemical discoveries.

An Arabian, Jabir ibn Hayyan (721-815), resident physician and alchemist to the Court of Caliph Haroun al-Rashid, became known through his work as the "father of Arabian chemistry." He produced more than 2,000 treatises on alchemical processes. For the most part, these were factually written and bore little of the mysticism which shrouded the observations of previous workers.

> **"By happy alchemy of mind**
> **They turn to pleasure all they find."**
>
> **-Matthew Green**
> **(English poet 1696-1737)**

From his lengthy experimentation with cinnabar, he believed that gold would result if mercury and sulphur could be combined in the correct proportions.

A barren period of little progress ensued, until the start of the 12th century, when Christian scholars' transcription of these ancient writings effected a revival of interest in the art.

In the 14th century, a Spanish alchemist - who referred to himself as Geber in deference to Jabir ibn Hayyan — was one of the fore-runners of this alchemical revival.

His writings were detailed, if occasionally obscure. He was clearly familiar with the processes of distillation, sublimation and crystallisation.

The humanitarian aspects of alchemy were investigated by Paracelsus (1493-1541). The Swiss alchemist and Physician of the city of Basle, was a pioneer of medical chemistry. He lectured that the alchemical process should be utilised in order to prepare more effective medicines.

Paracelsus was an eccentric genius. He was one of the first medics to make the connection between occupation and disease, by recognising silicosis as a hazard of coal mining; he pioneered treatments for sexually transmitted diseases and recognised the symptoms of mental illness which had previously been regarded as the result of demonic possession. He was a visionary who claimed it was possible to create human life in the laboratory and produced full, experimental data on the subject.

His ideas were generally accepted, even though many were obscured by the ubiquitous mysticism usually associated with alchemy. He was, however, overbearingly boastful of his achievements and was frequently the worse for alcohol, which did little to endear him to his peers.

In the 1600s there were many who sought the philosopher's stone. Cascariolo, an Italian alchemist thought he had found it with the "Bologna Stone"; this was subsequently shown to be the mineral barite.

French Chemist, Geoffroy, refuted the existence of a philosopher's stone, but believed iron could be formed by the burning of vegetation. Heating, or burning, was an important part of the alchemical process and the phlogiston theory— then in its heyday—was embraced by many leading alchemists.

Johann Becher, whose theories of combustion influenced Stahl to formulate the phlogiston myth, attempted in 1635, to turn sand from the banks of the River Danube into gold.

Even Isaac Newton was not immune from the 17th century Gold Rush. Alchemy was, by then, considered to be a reputable pursuit.

Betty Jo Dobbs in *The Foundations of Newton's Alchemy* quotes Isaac Barlow, Newton's friend and mentor, speaking of those in Cambridge "who fear not to espouse the cause of the noble goldmaking stone with lavish faith, whether it be fable or history."

It seems likely that Newton first experimented with alchemy as an undergraduate, or even possibly, as a schoolboy. His lab notes of 26 June 1682 detail several heatings of "regulus of copper, mercury sublimate, salts of ammonium" and the resultant precipitate being "not readily dissoluble in aqua fortis [NHO_3]".

Newton's progress with alchemy remains unclear, but he expressed concern in a letter in 1676 to Robert Boyle, who had recently published a vague account of his creation of a "hot amalgam of mercury", begging him not to reveal his production methods, because of the potential "immense damage to the world ..... there

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being other things besides the transmutation of metals."

Newton's chief concern may have been his disappointment at a rapid increase in the number of advocates of Hermetism, or spiritual alchemy, or it could have had a more substantial base.

The potential worth of a successful transmutation process was immense. Alchemists had often enjoyed the patronage of kings and, in Prague (Alchemy Central), Roman Emperors, Maximillian and Rudolf, had been major sponsors of the pursuit.

However, the threat to the gold market and, therefore, social stability (possibly even world order), was an ever-present source of worry to seekers of the "elixir".

Scots chemist, Alexander Seton was actually imprisoned in 1603 for his blatant, public demonstrations of transmutation.

So, as with all processes which threaten an established and coveted economy, alchemy was gradually dispatched to the scientific trash can.

It rapidly lost respectability and its remaining exponents were treated with derision and contempt. This, despite the immense storehouse of knowledge gained by "orthodox" science directly as a result of the dabblings of early alchemical practitioners.

The discovery of mineral acids; the isolation of gases and a vast addition to the repertoire of known chemical substances cannot be ignored. Alchemy, if not the entire foundation of modern chemistry, was certainly one of the cornerstones.

A. Rupert Hall sums it up nicely in *Isaac Newton —Adventurer in Thought*, when he says: "To be known as an alchemist in the late 17th century was less bizarre than it would be in our own time in which, however, astrology seems to flourish."

Bauxite—Continued from page 92.....

also been announced that Jamalco will merge with Aluminum Partners, owned by Kaiser Aluminum of Houston and Hydro Aluminum of Norway, Jamaica's largest refiner. June 13, 1997 *Miami Herald*.

7. Refining the bauxite at the mining site allows Jamaica to export almost twice the amount of alumina as bauxite.

8. Dr. Edmund Storms reviewed over 190 studies of the "cold fusion" effect in his paper titled "Critical Review of the 'Cold Fusion' Effect," which was published in the *Journal of Scientific Exploration*, 1996.

9. In September 1988, hurricane Gilbert destroyed power delivery systems, which affected many industries including the bauxite-alumina industry. In addition to the agricultural loss and the personal loss, the hurricane's attack on the island's infrastructure led to economic losses which were felt well into the following year. *World Atlas for Windows* by The Software Toolworks 1990.

"Cold Fusion" and Modern Alchemy

by Eugene Mallove

Since the 1989 advent of cold fusion, the smell of alchemy has lurked in the background. In fact, some of the most strident critics of cold fusion have mocked the field by comparing its alleged fantasies with "dreams of the ancient alchemists." Ironically, it appears now that transmutation of heavy elements at low energy is an inherent part of cold fusion phenomena.

First it was helium-4 that was "fused" from heavy hydrogen nuclei, so it was thought (and this may yet be proved true). Tritium formation in cold fusion was the earliest *unambiguous* nuclear miracle—not quite an alchemical identity change, but still a shocking wonder. Tritium is now very well documented in the cold fusion literature. Of course, it has been decried by cold fusion's critics as fraud or incompetent measurement. Then came evidence of transmutations in liquid and gas phase systems—low level stuff, but high enough above noise level for alarm bells to go off. We were no longer in Kansas!

Wonder of wonders—one of cold fusion's critics, physicist Dr. Kevin Wolf at Texas A&M University, obtained unambiguous evidence of transmutations in palladium from his Pons-Fleischmann cells (see "Alchemy Nightmare"—*IE* issue #1) in 1992. This was about the time of the first "Gold Crisis," the pyrotechnic-initiated thermal alchemy experiments at Texas A&M in the laboratory of Prof. John O'M. Bockris. The evidence for precious metal formation from lead or mercury was not then unambiguous, but it was certainly intriguing.

Fast forward a few years: gold-making reports are now on the internet as transmutation expert (guru?) Joe Champion dispenses advice on various alchemical techniques for precious metals making from lead or mercury.

This is either complete madness or something very big indeed! I strongly suspect it is the latter. As I editorialized in this month's column, "Electro-Alchemy," the gold-making scene now includes a stalwart of *hot* fusion and occasional cold fusion critic, mathematics professor Dr. Barry Merriman of UCLA. Dr. Merriman has been traveling the country with Joe Champion, visiting alleged commercial precious metal transmutation sites in Nevada, Texas, and God knows where else. It is inconceivable that at least *some* of the upper echelons of the precious metals industry are not aware of these happenings.

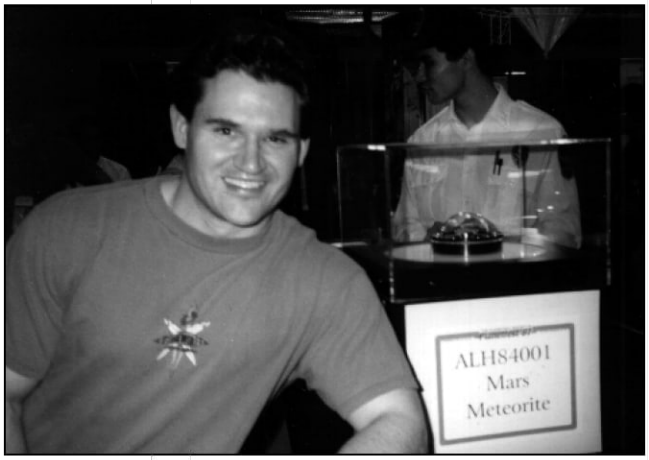
Barry Merriman has been spending thousands of dollars of his own resources on metallurigcal equipment, not to mention travel, in pursuit of the gold-from-lead Genie. We think this is very admirable. He is not out to make a lot of money on backyard gold production. Instead, he has a very scientific approach to his investigations: examine the processes suggested (or displayed at alleged commercial levels) by Joe Champion and learn whether they can be made repeatable. These rather simple processes are said to be finicky, but they are apparently very clear when positive results emerge.

The problem has become a serious conundrum:

(A) Sufficient positive results have been obtained to have obviously whet the appetites of serious researchers like Professor Bockris and Dr. Barry Merriman. So,

(B) Are we dealing "merely" with "enhanced precious metals extraction" from base metals, or are these people witnessing actual low-energy transmutations—at levels (a reported 0.1% to 10% lead conversion rate) that could lead to a new kind of precious metals manufacturing industry?

(C) Whatever the answer to (B), there are profound implications for the precious metals industry. However, if bulk transmutation is occurring at anywhere near the reported levels, the world of physics is turned



Dr. Barry Merriman at Planetfest-97 in Pasadena at the time of the Mars Pathfinder landing. Antarctic Mars meteorite fragment—still controversial regaring alleged life-forms—is on display. At Planetfest, the author had a chance to speak with Dr. Merriman about his adventures with Joe Champion and precious metals-making experiments. His is a genuine intellectual quest for truth. We wish him well and we hope to catch up! —*Photo: E. Mallove*

Continued on page 118

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"Gold Fusion": *The Economics of Alchemy*

by Charles Barr

Editor's Note:

Charles Barr has a B.A. degree in History from the University of Georgia and an M.A. degree in Economics from the University of Nevada. Currently he does economic consulting, statistical research, and software development, specializing in business applications. He lives in Las Vegas, Nevada (cfbarr@aol.com)

Sir Isaac Newton was an alchemist. Although his fame today rests upon his genius as a mathematician and a physicist, Newton spent much of his life in a failed attempt to transmute base metals into precious ones. Later scientists regarded Newton's obsession as an unfortunate lapse into pseudo-science and mysticism. Now it appears that he may simply have been 300 years ahead of his time.

Researchers are reporting that several elements, including gold, are being produced from other elements in cold fusion laboratories. If scientists and engineers develop methods to perform such transmutations in large quantities at low cost, the effect on the global economy will be profound. As rare elements become more abundant and prices fall, entrepreneurs will discover new uses for them, while old ones may disappear. Because of its deeply entrenched historical, cultural and economic significance, the application most likely to engage the public's attention will be the transmutation of gold.

Since ancient times, gold has been the most valuable monetary metal, its properties making it the closest thing to ideal as both a medium of exchange and a store of value. Because of its attractiveness, it has also been popular as an item of jewelry. And more recently gold has become useful in a variety of technological products, although its high cost has limited its application in this area.

A major characteristic of gold that has made it so useful as money, and to a lesser extent as jewelry, has been its scarcity. Because virtually all of the worldís cultures have placed a high value upon gold, and because there is a relatively small amount of it, gold bars and coins have been extensively employed as units of account for domestic and international trade.

What would happen if gold suddenly were no longer scarce? Would it become just another common metal, like copper, iron, nickel or tin? Or would it retain its status of "precious metal" that has held throughout all of recorded human history?

The answer would depend partly upon the price level that gold would eventually reach, and this in turn would depend what it would cost to "alchemize" gold from other metals. At this writing, the price of gold is about $325 an ounce, down from a year-ago high of about $415 an ounce. In order for transmutation to be profitable, a process must be developed that can produce an ounce of gold for less than the current price, including overhead and labor.

Assume for the sake of argument that gold could be transmuted at $50 per ounce. As the general public became aware of that fact, the price of gold would fall dramatically. The initial wave of selling would likely come from government central banks, which currently hold billions of dollars worth of gold to back their currencies. Such "dumping" has already begun, by governments in Europe and Australia, although the reasons have nothing to do with cold fusion. Many governments are convinced that inflation is becoming a problem of the past, so they do not feel the necessity to stockpile a non-performing asset such as gold.

Newton spent much of his life in a failed attempt to transmute base metals into precious ones. Later scientists regarded Newton's obsession as an unfortunate lapse into pseudo-science and mysticism. Now it appears that he may simply have been 300 years ahead of his time.

Gold is almost never used as money in day-to-day transactions anymore, but despite recent dumping, many nations still maintain substantial reserves of gold to demonstrate to the world the "soundness" of their currency. These reserves would lose the greater portion of their value very quickly, and some of the weaker "gold-backed" currencies could suffer a devaluation as a consequence. Private holdings of gold would also tumble in value. This would not cause a severe problem in the United States and other developed nations. But it would affect millions of people in Asia and other areas of the world, where gold is accumulated as a form of tangible and portable wealth that can protect its owner from inflation of the local currency, and can be spent or traded during times of economic or political crisis. A drop in the value of gold would make it less suitable for these purposes.

Even at $50 an ounce, however, there would still be no ready replacement for gold as the premier monetary metal, especially if other scarce metals could also be transmuted through cold fusion processes. So for those who value "hard money," gold would probably continue to be the metal of choice, even at a much lower price. There is a precedent for this scenario: The California gold rush of the 1850's greatly increased the world's supply of gold and lowered its value in relation to other goods, but gold continued to function as the monetary standard throughout this period.

Gold currently enjoys widespread application in industry, medicine and technology. For example, gold is extensively used in dental fillings and in sensitive electronic equipment, such as computers. A lower price for gold would make many of these applications more affordable, and would lead to discovery of additional uses for the metal.

A dramatic plunge in the gold price, to the $50 level or below, would likely force most gold mines to close their doors for good. Many mines have already suspended operations in the wake of this year's 20 percent price drop. If the price were to fall below $200, virtually all mining companies would be unable to make a profit. There would be only two possible ways for them to stay in business: Adopt transmutation techniques to produce gold, or use cold fusion "free energy" technology to slash mining costs to the $50 per ounce level. Under either circumstance, competition from new producers would likely cut profit margins to the bone and devastate earnings, putting severe pressure on the price of most gold mining stocks.

Gold has always been popular as jewelry, and it can be expected that a plunge in gold prices will make it more so. Imagine being able to buy a gold watch for less

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than $100! Even people on limited incomes would be able to afford gold necklaces, bracelets, pendants, cuff links, and earrings. Jewelry would probably be one of the chief sources of demand for gold as it became more abundant. Existing gold jewelry would lose much of its value, as the market became flooded with baubles made from "alchemized" gold. Demand by the wealthy for gold jewelry might actually drop, as it would lose much of its exclusivity. Jewelry stores would be unable to maintain high profit margins on what would now be in many respects a "commodity" product.

We would see an increase in the number of gold coins produced each year, despite the fact that they have not circulated as money for decades. Many nations, including the United States, issue gold commemorative coins for collectors, as well as one-ounce and fractional-ounce "bullion" coins, whose gold content is guaranteed by the issuing government. These coins would become more affordable and result in increased sales. (Interestingly, the U.S. one-ounce coins have a face value of $50, so if the price of gold dropped to this level it would become possible to spend them!) One of the few forms of gold that would increase in price would be rare gold coins. A substantial drop in the price of gold would encourage many coin collectors to begin assembling gold coin sets, creating explosive demand for the hard-to-find coins necessary to complete these sets.

If the transmutation of gold in commercial quantities becomes possible, it will dramatically alter our perception of gold and the uses to which we put it. However, even at a much lower price, gold will most likely retain the unique significance it has enjoyed since the dawn of civilization. The mystique of gold, and its worldwide popularity, make it an ideal candidate for focusing the attention of the world on the progress and the possibilities of new energy technology.

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"Modern Alchemy"— Three historical reports

•The Transmutations of Ores
•Transmutations of Silver to Gold
• The Ohsawa-Kushi Transmutations

by Robert Nelson

The Transmutations of Ores

Robert Nelson
(Rex Research: P.O. Box 19250, Jean, NV 89019)

1. Introduction... 2. T. Moray... 3. Dunikovski... 4. A. Klobasa... 5. A. Conrad... 6. D. Hudson/ORME... 7. References

1.Introduction

The synthesis of elements by high-energy bombardment of other elements is common knowledge and practice among nuclear physicists. In their fashion, modern physicists also have accomplished one of the goals of alchemy: the production of artificial gold. However, the yields are low and the product is unstable and very expensive. Such nuclides find only limited use in medicine and chemistry.

For example, R. Sherr, et al., reported the "Transmutation of Mercury by Fast Neutrons" of lithium and deuterium. These formed three radioactive isotopes of gold by the n-p reaction, and three isotopes of platinum.(1)

In 1980, a group of researchers at Lawrence Berkeley Laboratory (Glenn T. Seaborg, *et al.*) reported the production of a few billion atoms of gold as the "trivial result" of an experiment with a Bevalac accelerator. A bismuth target was bombarded with a "relativistic projectile" that chipped some protons from the Bi nuclei, forming gold. The experiment produced less than one-billionth of a cent worth of gold. (2-4)

In 1980, Andrew Melchanov, a Chicago publisher, reported that Soviet "physicists at a nuclear research facility near Lake Baikal in Siberia accidentally discovered a fusion reaction for turning lead into gold [in 1972] when they found the lead shielding of one of their experimental reactors had changed to gold." At that time, it was expected that Russia would be able to mass-produce gold for about $600/oz.(5)

Several researchers in the 20th century have reported their methods of producing profitable amounts of values from base metals and low-grade ores without the use of nuclear reactors. Some of the methods are genuine low-energy alchemical transmutations.

2. T. H. Moray

The Moray process is a prime example of what is possible. In 1950, Thomas H. Moray was approached with a request to investigate the possibility of improving the extraction of uranium ores. As a matter of course, the Moray Research Institute (MRI) proceeded by bombarding the ore in an "environment" with x-rays as high as 24 MeV before attempting to extract the values. The average ore contained 0.23% uranium oxide. After irradiation, the ore yielded from 7-75% uranium oxide!

In 1953 the MRI proposed that the Atomic Energy Commission (AEC) investigate such a project for the "aging" of atomic ores by a "breeding type reaction with high-energy particles or x-rays in the presence of a proper environment." The AEC declined to grant a contract.(6-8)

In 1958, MRI adapted its process to the augmentation of precious metal ores. The Moray process uses three main categories of ores, containing traces to a few hundredths of an ounce of gold and silver per ton: 1) low-grade unprocessed gold ore; 2) mill tailings—especially advantageous; this material costs very little, is ground already, and yields excellent results. Higher grade ores seem to be less adaptable to this process; they yield much less of an increase in values than do low grade ores.

"Early tests gave yields of 50-100 oz.. gold/ton ore. While virtually no gold or silver values can be determined in the raw ore, after irradiation and drying the gold and silver can be identified by standard fire assay or any other normal determination methods...

"Metals not otherwise detected are freed for a separation by normal separating processes. This process does not purport to be a separation process in any way in that upon completion of irradiation the samples will have to be disposed of expediently."(6)

The Moray process utilizes an "environmental solution," developed in 1949. Aging became a problem as chemical reactions continued to take place due to hydration and temperature changes. By 1961, the MRI had refined several formulas of solutions, one or more of which work well with most ore types and do not require any aging. They can be used immediately after mixing and can be stored without adverse effects. Their cost is approximately $50/100 gallons (the volume of solution required to process one ton of ore). The solution is heated to an "elevated temper-

ature" during irradiation.

In a telephone interview with John Moray (Ken Jones, September 1981), he said: "The environmental material consists of a combination of chemicals whose atomic numbers add up to the atomic number of silver or gold and yield silver and gold upon irradiation." The formulas include arseno- and iron-pyrites in alkaline solution. Moray adds, "Antimony has peculiar properties—it has floating electrons which come in very handy. It is believed that this environment furnishes particles similar to the cosmic ray reaction on the atmosphere. Research work indicates that the radiation must be composed of both high-speed electrons and x-rays. Consistent results under controlled methods were obtained with the addition of a catalyst (a flux or reduction agent, an environment) combined with bombardment of the material ... by an energy bombardment tube developed for the Research Institute."

The "bombardment tube" may be a preferred embodiment of Dr. T.H. Moray's "Electro-Therapeutic Apparatus" (US Patent #2,460,707, Cl. 128-421; Feb. 1, 1949) In abstract, the invention is described as an "apparatus for applying radiant energy therapeutically, comprising means for producing high potential, high frequency electricity; a high capacity sparking condensor; and a treatment electrode connected in circuit with the foregoing..."

The patent states that "The invention has been described in the foregoing with sole reference to its use for therapeutic purposes. It should be noted, however, that inorganic matter may also be treated to advantage pursuant to the methods and with the apparatus... it has been found that metals, for example, lead, have changed physical properties after treatment in accordance with the above..."

According to an article by T.R. Dolph, published in *Fate* magazine, "Dr. Moray engaged my father-in-law, attorney Victor G. Sagers, Midvale, Utah, to represent him in offering the device to the US Government... Transmutation of metals (yes, turning lead into gold) was demonstrated several times; the government supplied the lead and kept the gold."(9)

John Moray responded (Jan. 18, 1982 to Ken Jones): "The article by T.R. Dolph, Garland. TX, is one of those articles written by a crackpot that has in fact mixed together a number of unrelated facts. There is no such device as described in *Fate* magazine... The bombardment tube does exist. However, this has nothing to do with the recovery of minerals from low grade ore. The bombardment tube is a part of the therapy device.

"The story of gold and lead supplied by the US Government is a complete fabrication. My father and I always detested liars, and this man Dolph is a compulsive liar. His father-in-law, Vick Sagers, would never have said anything similar to what this man has said."

In a later letter to Ken Jones (Feb. 11, 1982), John Moray added: "The bombardment tube is electrotherapy and does not apply to the mining or mineral recovery process, regardless of how you interpret the patent.

"The patent application is speaking of a 'method' and has to do with an individual trained in the art of that 'method' which is all the law requires, and therefore, changing the physical properties of lead, i.e., making it possible to be alloyed with copper or developing a lead semi-conductor has nothing to do with the mineral process again."

The services of the late eminent physicist W.J. Hooper (Prof. Emeritus, Principia College) and other scientists were solicited in an effort to discover what was producing such results. It appeared to be caused by "a rapid buildup of atoms of relatively low atomic weights to those of much higher atomic weightsî such as silver, gold, and platinum."

In a progress report at the 68th National Western Mining Conference (Denver, CO; Feb. 4, 1965), Dr. Hooper announced:

"First of all, I will cite one of several tests carried out in an effort to ascertain whether the modus operandi was actually one of transmutation from elements of low atomic weights to those of the noble metals. A solution was prepared—made up of Baker's reagent quality chemicals of the highest purity and water, distilled by boiling. These bottled chemicals list the trace materials which might be existent in them. Gold did not appear on any of these lists even in trace amounts. No atoms of higher atomic number than 19 (K) were present in quantity in this solution. Silver has the atomic number of 47,and gold 79. This prepared solution of pure chemicals in glass containers is irradiated by high energy photons for about one minute and then by evaporation the residue was dried and sent to an independent assayer for analysis... It reads 939.76 oz. gold/ton and 113.04 oz. silver per ton...

"A point of great interest in the experimental test I have described is that the specks of gold found in the residue of the solutions reveal a marked crystal structure under microscopic examination. It is a coincidence that Miethe, back around 1925, found his formation of gold to be in small crystals also... The process we have described is in reality a crystal growing bath activated by irradiation. As the gold atoms come into being by transmutation, they become gregarious, which results in the crystal formation.

"From this observation there is every reason to suspect that low grade ores and mining tailings provide, not only the seed for crystal growth, but also a nuclei environment which is well advanced or uniquely favorable, for the formation of the precious metals by transmutation."

Dr. Hooper contended that the process is one of nuclear reaction. Dr. Hans Frauenfelde (Univ. Illinois) opined that the energy levels were too much of a departure from the accepted standards to verify this point. Another theory proposes that colloidal gold, lost in the dilution of ore in the environmental solution, is concentrated by the bombardment. The MRI insists that is not the case.

In 1963, MRI conducted experiments with a linear accelerator at the Electronized Chemicals Corporation (Rockford, IL) at energy levels of 11.4-20 MeV with doses of 1 megarad. The average yields were 8-9% gold! It was estimated that a production rate of 5 tons ore/day was possible with the available equipment. Computerized risk analysis indicated that yields over 11.5 oz. gold/ton ore could be expected with 99.5% certainty. A higher average (15 oz. Au/ton) could be expected in mass production under optimum conditions. Other experiments showed even more promise, yielding 100-200 oz. Au/ton (128 oz. Au/ton average). "The standard deviation of yields was rather high due to the constant modification of experimental conditions."

MRI rented time on the Varian Associates 8 MeV LINAC in order to test parameters such as dose, dose rate, slurry depth, shield material, electron volt setting, shield height, and the distance of the target from the irradiation source. The shield was a thin sheet of unspecified material placed over the sample while irradiating it.

"In main effects, only electron-voltage setting showed up as significant, with high-voltage setting being better than the low. In addition, several interactions between variables showed up as being significant. An interaction between two variables means that when either variable is changed singly, a significant difference results. Some interactions between three variables, or perhaps even more may be present. The following interactions seemed to be significant ones and seem to indicate that a higher voltage would give much better results: 1) Shield height/Voltage; 2) Dose rate/Voltage; 3) Dose/Voltage; 4) Distance of sample from radiation source/Shield height; 5) Solution depth/Shield material; 6) Slurry depth/Voltage.

"X-rays perform photo-disintegration,

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and the electrons furnish the energy and amperage to the reaction. It is suspected that because the escaping electrons have a certain amount of energy, a certain amount of x-rays will be produced in the material by the electrons' reactions (Compton Effect). The ideal reaction, it is indicated, is for the x-ray to be produced at a target located somewhere outside the accelerator tube where losses of energy would be minimal. This reaction is dependent on the following factors:

"1) The isomers of the isotopes reacted upon must be present in the ore before the ore will react to the reaction; 2) These reactions are dependent upon the type target in order to control the frequency of the quantum energy level; 3) High-energy electrons must be present in the ore as well as x-rays; 4) The composition of the environmental solution furnishes other particles that are freed by the action of the resonant frequency of the x-rays and the electrons produced by the particle accelerator; 5) The reaction is a dose-rate reaction and not dependent upon velocity. The velocity of the original particles will determine the depth and time of the reaction only. Over-radiation gives a deterioration rate and loss of values reported...

"As the size of the sample varies, the reaction varies on an inverse lineal level wherein doubling the size of the sample would cut the total reaction in half."

Radiation dosages of 0.16, 0.5, and 2.0 Megarads/minute gave peaks on the dosage curve. Four Megarads/minute gives the highest yield. Irradiation lasted one minute. The reaction also is wattage-dependent. The minimum wattage required is 200 watt-seconds per gram of ore.

"The process has to be adjusted to the characteristics of different ores. The chemical formulas and the resonant energy levels must be established for each ore.

"Consistency was achieved in 1970 by adding to the process a control resonant chamber (Magnetic Undulator) which acts to bring all variables into phase, or into a resonant relationship, with the radiation source, to a point where a consistency was obtained higher than any obtained prior to that time. There are definite peaks at which each ore that is of value with this process, releases the metals found within it. There are peaks for each metal ion within the ore."

The Magnetic Undulator establishes non-propagating, resonant standing waves with the x-ray diffraction wavelength of gold (2.042 Angstroms) in the environmental solution. The chemicals (in copper pans) were bombarded from above. Each bombardment increased the amount of gold 9-fold, but the yield later diminished to only three times the original amount. Consistently high, stable yields were obtained by first irradiating the trays from below and then applying x-rays from overhead. The yields increased 9-fold and remained at that level without deteriorating. The process as developed produces little increase in platinum values, probably due to: a) the energy level of the irradiation source; b) the chemical composition of the environmental solution; c) target type. The silver produced in this process assayed as high as 426 oz/ton.

"The reaction is sensitive to interference from nearly every material other than glass or porcelain. Plastics cannot be used, nor stainless steel, and most varieties of rubber or brass. Copper can be used if it is in one continuous piece. Indications are that interference is due to electrostatic charge or particle position in the solution."

Better results also would be obtained with suction pumping of the slurry in an all-glass system, rather than the makeshift conveyer belt/copper pan system used by MRI.

3. Dunikovski

In 1931, a Polish engineer named Dunikovski announced that he could produce artificial gold by the action of "Z-rays" on a mixture of silica and feldspar melted in bronze crucibles under the influence of 110 kilovolts. Dunikovski claimed to have perfected a process he inherited from his father and grandfather who had developed it. Dunikovski theorized that all minerals contain "embryonal atoms" or "mineralites" that can be artificially matured in minutes.

Several French investors syndicated and subscribed 2,000,000 francs which Dunikovski used to build a laboratory in Paris. But no gold was produced, and he was charged with fraud. He demonstrated his process to the court, but the results were ambiguous and insufficient to prove his innocence. Dunikovski was sentenced to four years imprisonment, but his attorney secured his release after two years. Dunikovski relocated to San Remo and renewed his experiments. He improved the process, gaining significant increases in yields.

His attorney (Jean Legrand) visited Dunikovski with the eminent chemist Albert Bonn to investigate the new situation. M. Bonn witnessed and replicated the process. One type of sand, which contained 11 grams Au/ton before treatment, assayed 859 grams/ton after treatment with the improved apparatus.

Subsequently, Dunikovski founded "Metallex, Societe Anonyme" with Belgian stockholders and established a factory on Lake Neuchatel. Nothing more is known about the affair, because all subsequent proceeding were kept secret.[10]

4. Adalbert Klobasa

About 1937, an Austrian chemist named Adalbert Klobasa claimed to have produced gold using an electromagnet and induction coil with which he treated a mixture of titanium-potassium-oxalate (36 gr.), ferrous sulfate (84 gr.), copper sulfate (50 gr.), sodium sulfide (50 gr.), ammonium chloride (100 gr.), ammonia (250 ml.), sodium silicate (20 cc.) and silica (440 gr.). The reaction was catalyzed with 100 mg. of silver. Two hours of treatment afforded a 1% yield of gold which appeared as brown-red scales. Klobasa claimed that gold is built up from iron, titanium, and sodium. He declined to enter into business with his synthesis because, he said, "I am too old, and not fit enough to worry myself chasing around after capitalists."[10]

5. Arnold Conrad

Another simple method which "ripens green ores" (volcanic sulfides, pyrites, or tellurides) was perfected by Arnold Conrad (Chico, CA). Conrad learned the process from a German scientist. The technique balances the ore's electropositive charge with 10-150 volts DC. The enhanced values are removed by electroplate refining (or in vacuo for Rh, Os, and Ir).[11]

"As all ores are different I may use from one to three additives... to assist in rejuvenating the chemicals and acids in ores. But any material eroded... by water is not amenable to this process."

Another similar method of transmutative enrichment was developed by some California alchemists in the 1970s:

"Smelt 2 lb. lead with soda ash and/or soda-borax. Use this as the anode, and a stainless steel or carbon rod as the cathode. The reaction with the ore is contained in a carbon crucible with 10% nitric acid as the electrolyte. Add extra flux as needed. The process is repeated from 7-21 times."

6. David Hudson/ORME

In the 1980s, David Hudson discovered the existence of ORMEs (Orbitally Rearranged Monoatomic Elements) which are virtually undetectable by conventional means (except for a distinguishing IR doublet located between about 1400 and 1600 cm^{-1}) because they lack a d-orbital electron. Hudson and associates developed a method to recover ORMEs and convert them into their metallic forms. While it is not a transmutation of one element into another (but rather, the conversion of an allotrope into the common visible form of the elements), the extraction and conversion of ORMEs to metal may explain the claims of some other experimenters. Certain ores, particularly sodic and calcidic

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plagioclase, contain large amounts of ORMEs which can be extracted by Hudson's process, as described in his Australian patent for "Non-Metallic, Monoatomic Forms of Transitional Elements" (1989):

"300 gr of dried material assayed by conventional techniques to show no gold present, ground to less than 200 mesh, is placed in a 1-gallon vessel, fitted with electrodes, with 120 gr NaCl, 10 gr KBr, and 2 liters of tap water.

"The anode consists of a pair of 3/8" x 12" carbon welding rods wrapped together with No.10 copper wire. The cathode consists of 1-5/8" ID x 14" glass tube with a medium porosity glass frit with a 1" x 14" x 1/16" stainless steel strip inside in a solution of 36 gr/liter NaCl (approx. 500 ml.). Both electrodes are placed into the sample vessel and supported by clamps extending about 5" into the sample solution.

"The sample is placed on a roller table at approx. 10 rpm. The electrodes are connected to a (120 V) power supply in conjunction with a 2-3 amp 400-600 PIV rectifier. A 100 W light bulb and the electrodes are hooked in series. The rectifier load is connected to the anode since the rectifier filters out all negative voltage and only passes positive voltage.

"The sample is kept under load for a period of 6-1/2 hours. The final pH is in the range of 3-6.5. The voltage across the electrode is 5 volts. After disconnecting the load, the sample as allowed to settle and the solution over the settled out material was removed by decantation...

"800 ml. of the sample was placed in a 1000 ml beaker and 20 ml concentrated sulfuric acid was added to the solution. With stirring, the solution was boiled down slowly on a hotplate until the solution was just dry (not baked). The just dry salt contains sodium gold chloride. The just dry salt was taken up in 400 ml deionized water and again boiled down to the just dry condition. There should be no discoloration at this point, i.e., a clear solution is formed.

"The just dry salt was then taken up in 400 ml. 6M HCl, and thereafter boiled down to the just dry condition. The dilution and boiling down step was repeated four times, alternating with a deionized water and a 6M HCl wash, with the sequence controlled to that the last washing was with 6M HCl. The purpose is to remove all traces of hypochlorite oxidant.

"The just dry salts are taken up in 400 ml anhydrous ethanol and stirred for approximately 10 minutes. This step is to dissolve the gold chloride salt, to remove the sodium chloride. After stirring, the slurry was filtered through #42 paper on a Buchner funnel.

"5 ml of concentrated sulfuric acid was slowly added to the filtrate, mixed, and the filtrate was then allowed to sit for approximately 1 hour. The filtrate was filtered through #42 paper on a Buchner funnel, hand then passed through a filter of 0.5 micron Teflon. The sulfuric acid precipitates out any calcium. Filtration removes the precipitant and a light yellow filtrate is recovered, with all traces of calcium sulfate removed.

"The light yellow solution was again boiled down to just dry, taking care to avoid any charring. At this point there should be no further evaporation of ethanol and the just dry residue should be free of color. The residue should have a sweet smell similar to burnt sugar. The occurrence of the sweet smell indicates the end point of the boil-down.

"The just dry residue is taken up in 600 ml deionized water to provide a water-soluble gold form which is the gold auride. If desired, the G-ORME can be recovered at this stage or converted into metallic gold. For gold recovery, the solution is put into a 1000 ml beaker and an electrolysis unit was set up... The anode is a gold electrode, 2 cm^2 in size, upon which gold solution will plate out. The cathode comprises a 6.8 cm^2 platinum electrode confined in a Nafion 117 chamber... Inside the Nafion chamber I 200 ml of electrolyte solution containing 5 ml sulfuric acid per 600 ml of electrolyte solution. It is important to keep the Nafion chamber wet at all times. The potential was measured across the electrodes and then an additional -2.2 volts potential was applied and maintained for a period of 2 hours.

"After the two hours, the potential was raised to 3.0 volts and maintained for approximately 18 hours. Bubbles formed on both the gold and platinum electrodes. A black material formed on the gold electrode after 3-4 hours. The gold electrode was removed from solution while voltage was still being applied. The electrode was dried in a vacuum oven overnight at 115° C. The electrode was weighed before and after the plating to determine the mount of gold collected.

"The metallic gold is, therefore, produced from a naturally-occurring ore which, when subjected to conventional assaying, does not test positive for gold."

The ORMEs are produced from sodium gold chloride, which is reduced to sodium auride. "Continued aquation results in dissociation of the gold atom from the sodium and the eventual formation of a protonated auride of gold as a grey precipitate. Subsequent annealing produces the Gold-ORME. The G-ORME has an electron arrangement whereby it acquires d-orbital hole or holes which share energy with an electron or electrons. This pairing occurs under the influence of a magnetic field external to the field of the electron.

"G-ORMEs are stable [as] demonstrated by unique thermal and chemical properties. The white salt-like material that is formed when G-ORMES are treated with fuming $HClO_4$ or fuming H_2SO_4 are dissimilar from the transition (T) metal or its salts. The G-ORME will not react with cyanide, will not be dissolved by aqua regia, and will not wet or amalgamate with mercury... The G-ORMEs remain as a powder at 1200°C...

"G-ORMEs can be reconverted to metallic gold from which they were formed. This reconversion is accomplished by an oxidative rearrangement which removes all paired valence electrons together with their vacancy pair electrons, with a subsequent refilling of the d and s orbitals with unpaired electrons until the proper configuration is reached for the T-metal.

"This oxidative rearrangement is effected by subjecting the G-ORME to a large negative potential in the presence of an electron-donating element, such as carbon, thus forming a metallic element-carbon chemical bond. For that metal-carbon bond to occur the carbon must provide for the horizontal removal of the d orbital vacancy of the ORME. The carbon acts as a chemical fulcrum. When the element-carbon bond is reduced by way of further decreasing the potential, the carbon receives a reducing electron and subsequently vertically inserts that reducing electron below the s orbitals of the element, thus forming metallic gold.

"The above description for the preparation of G-ORME from commercially available metallic gold is applicable equally for the preparation of the remaining ORMEs, except for the specific potential energy required and the use of nascent nitrogen rather than carbon to convert the other ORMEs to their constituent metallic forms. The specific energies range between -1.8 V and -2.5 V depending on the particular element. Alternatively this arrangement can be achieved chemically by reacting NO gas with the T-metal ORMEs other than gold. Nitric oxide is unique in that it possesses the necessary chemical potential as well as the single unpaired electron."

7. References

1. Sherr, R., et al.: *Physical Review* 60(7):473-479 (October 1941).

2. Garretson, Fred: *Oakland Tribune* (Sat., 22 March 1980), p. A-7.

3. *American Business* (April 1980), p. 16.

4. *Star* (12 February 1980).

5. Melchanov, Andrew: *Chicago Elite* (January 1980).

6. I. "Recovery of Minerals from Low-Grade Ore by High Energy Bombardment"; (68th National Western

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Mining Conf. (Denver, CO; 4 February 1965).
II. Hooper, W.J.: "Startling Possibilities in Artificial Transmutation", p. 5-7.
III. Hendricks, Ruth L.: "History of Research Project", p. 8-9.
IV. Rudolph, Th. E.: "Statistical Evaluation Research Report", p. 10-12.
7. Hendricks, Ruth L.: "Affidavit" (5 November 1975).
8. Olsen, Prof. L. M.: Financial & Statistical Evaluation: "Recovery of Minerals from Low-Grade Ore by High-Energy Bombardment".
9. Dolph, T.R.: *Fate* 29(2), #311 (February 1976).
10. Doberer, K.K.: *The Goldmakers*; 1948, Nicholson & Watson, London.
11. Conrad, Arnold: *California Mining Journal* (February 1973), p. 13.

Transmutations of Silver to Gold

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1. T. Tiffereau... 2. R.M. Hunter... 3. A.E. Waite... 4. Fulcanelli... 5. Fr. Jollivet-Castelot... 6. Dr. S. Emmens... 7. Allotropic Silver... 8. References

The manufacture of gold from other elements can be achieved by several methods. This review includes electronic treatments of ore such as invented by T. H. Moray. The penultimate means of transmutation is the "Philosophers' Stone of any degree," but that is another subject altogether. Most of the experimenters in the 19th and 20th centuries used a variety of "wet" techniques with nitric acid, or "dry" transmutations with catalytic alloys (especially arsenic) in the furnace. Dr. Stephen Emmens added high-pressure hammering (500 tons/sq. in.) of allotropic silver at low temperature, followed by fluxing, granulation, more hammering, treatment with ìmodified nitric acidî, and refining.

1. Th. Tiffereau

Between 1854-55, Theodore Tiffereau submitted six memoirs to the French Academie des Sciences concerning transmutations of silver to gold. He published a compilation of the papers (*Les Metaux sont des Corps Composes*) in 1855. [1-3]

Tiffereau conducted his experiments at considerable expense while supporting himself making daguerotypes in Mexico. Tiffereau claimed that Mexican silver possesses peculiar qualities which lend to its augmentation as gold (Dr. Emmens also used Mexican silver in his work). While he claimed success in principle, he made no capital gains. Tiffereau demonstrated his process at the French Mint (Paris) before the assayer M. Levol, but the results were unsatisfactory. According to Tiffereau, the reason was that Mexican silver possesses peculiar qualities which lend to its augmentation as gold. It is perhaps significant that Dr. Stephen Emmens also used Mexican silver in his Argentaurum process.

Tiffereau attempted many modifications of his techniques, and claimed that certain experimental conditions influence the transmutation of silver to gold:

1) Pure silver filings were used, sometimes mixed with pure copper filings (Ag 9:1 Cu) and traces of zinc, iron, alumina and silica.

2) Trace amounts of gold catalyze the reaction.

3) The silver was refluxed with concentrated nitric acid, hyponitrous acid, and nitrogen protozide or deuteroxide

4) Concentrated sulfuric acid was used at times

5) The acids were exposed to sunlight to "solarize" them. Tiffereau complained that the French sun[light] was not so effective as the Mexican.

6) Halides and sulfur in the presence of oxides of nitrogen improved the reaction, and so did ozone.

7) Prolonged reaction time increased yields.

Tiffereau attributed the production of gold in the earth to the action of the "microbe of gold." This was confirmed in the 1980s by the discovery that placer gold nuggets form around a nucleus of bacillus cereus.

The following experiment is typical of Tiffereau's general methods:

"After having exposed, over two days, pure nitric acid to the action of solar rays, I added pure silver filings with pure copper filings in the proportions of the alloy of money (9:1). A lively reaction manifested, accompanied with a very abundant deposit of intact filings agglomerated in a mass.

"The disengagement of nitrous gas continued without interruption, and I left the liquid as is over twelve days. I noted that the aggregate deposit was augmented sensibly in volume. I then added a little water to the dissolution in which the product had precipitated, and again abandoned the liquid to rest five days. During this time, new vapors unceasingly disengaged.

"The five days having passed, I raised the liquid just to ebullition, which I maintained until the nitrous vapors ceased disengagement, after which I evaporated it to dryness.

"The matter obtained from the dessication is dry, dull, blackish-green; it did not offer an appearance of crystallization...

"Placing the matter again in pure nitric acid and boiling six hours, I saw the matter become clear green without ceasing to aggregate in small masses. I added a new quantity of pure concentrated nitric acid and boiled it anew; it is then that I finally saw the disaggregated matter take the brilliance of natural gold."

Tiffereau's third test in this series "presented an extraordinary phenomenon to be noted: the quantity of the alloy that I used experienced a transformation entirely to pure gold."

Carey Lea suggested that Tiffereau and other experimenters had merely prepared a gold-colored form of allotropic silver.

2. R. M. Hunter

In 1908, Sir Henry Baskerville mentioned that "Among the many communications reaching the writer, one is of more than passing interest. Mr. R.M. Hunter, of Philadelphia, has written concerning 'synthetic gold' as follows:

"'I have so perfected the process that in my judgment, based on my actual experience, gold may be manufactured at enormous profit, and to this end I have designed a plant to be erected in Philadelphia and am at this moment negotiating for $500,000 capital for its erection. I realize that the public and most scientific men are adverse to the belief in the possibility of such an enterprise, but I know what I am doing and can afford to allow public sentiment to follow its own course.'

"Enclosed with the letter was an affirmative affidavit. On request, Mr. Hunter promptly forwarded me samples of silver in which the gold is 'growing' and some 'grown-up' gold, said to have been produced by his secret process. I have not made analyses of the samples."

Apparently, Mr. Hunter never succeeded with his plans.[4]

3. A. E. Waite

The eminent occultist Arthur E. Waite wrote "A Collection of Alchymical Processes" which includes a segment entitled "Silver Transmuted Into Gold By The Action Of Light":

In the focus of a Burning-Glass, 12 inches in diameter, place a glass Flask, 2 inches in diameter, containing Nitric Acid, diluted with its own volume of water.

"Pour into the Nitric Acid, alternately, small quantities of a Solution of Nitrate of Silver and of Muriatic acid, the object being to cause the Chloride of Silver to form a minutely divided state, so as to produce a milky fluid, into the interior of which the brilliant convergent cone may pass, and the currents generated in the Flask by the Heat may so drift all the Chloride through the Light.

The Chloride, if otherwise exposed to the Sun, merely blackens on the surface, the interior parts undergoing no change: This difficulty, therefore, has to be avoided. The Burning-Glass promptly brings on a decomposition of the salt, evolving, on the one hand, Chlorine, and disengaging a metal on the other. Supposing the experiment to last two or three entire hours, the effect will then be equal to a continuous

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midday sun of some 72 hours. The Metal becomes disengaged very well. But what is it? It cannot be silver, since Nitric acid has no action on it. It burnishes in an Agate Mortar, but its reflection is not like that of silver, for it is yellowish, like that of Gold.

"The Light must therefore have so transmuted the original silver as to enable it to exist in the presence of Nitric Acid."(5)

4. Fulcanelli

The renowned incognito adept Fulcanelli published this transmutation of silver in *Les Demeures Philosophales*:

"The simplest alchemic procedure consists in utilizing the effect of violent reactions —those of acids on the bases — to provoke in the midst of the effervesence the reunion of pure parts, their new arrangement being irreducible. In this manner, starting from a metal close to gold --- preferably silver --- it is possible to produce a small quantity of the precious metal. Here is, in this order of research, an elementary operation whose success we guarantee, providing the instructions are carefully followed.

"Empty into a glass retort, tall and tubular, one-third of its capacity in pure nitric acid. Adapt to the receiver an escape tube and arrange the apparatus in a sand bath.

"Gently heat the apparatus short of reaching the boiling point for the acid (83° C.). Turn off the fire, open the tube, and introduce a small portion of virgin silver, or of cupel, free from gold traces. When the emission of peroxide of azote has stopped and when the effervesence has quieted, let drop into the liquor a second portion of pure silver. Repeat introducing metal, with no hurry, until the boiling and issuing of red vapors manifest little energy, which is indicative of the property of saturation. Add nothing more. Let it rest for half an hour, then cautiously decant your clear solution into a beaker while it is still warm. You will find a thin deposit in the form of black sand. Wash this with lukewarm water, and let it fall into a small porcelain capsule. You will recognize by making the assays that the precipitate is insoluble in hydrochloric acid, just as it also is in nitric acid. Aqua regia will dissolve it and yields a magnificent yellow solution, exactly like gold trichloride. Use distilled water to dilute this liquor; precipitate from a zinc blade. An amorphous powder will be obtained, very fine, matte, of reddish brown coloration, identical to that given by natural gold reduced in the same manner. Wash well and dessicate this pulvurent precipitate. By compression on a sheet of glass or marble, it will give you a brilliant, coherent lamina with a beautiful yellow sheen by reflection, green by transparence, having the look and superficial characteristics of the purest gold.

"To increase with a new quantity this miniscule deposit, you may repeat the operation as many times as you please. In this case, take up again the clear solution of silver nitrate diluted from the first washing water; reduce the metal with zinc or copper. Decant this silver into a powder and use it for your second dissolution." (6)

5. F. Jollivet-Castelot

Francois Jollivet-Castelot was the Secretary General (and later President) of the Alchemical Society of France (founded in 1896). He also edited the Society's journal *L'Hyperchemie*, and served as a special delegate of the Supreme Council of martinists. He authored several books and articles on alchemy and "hyperchemy," a system of non-occult chemical methods of transmutation. (1, 2, 4, 18-21) (7-13)

Jollivet-Castelot began experimenting with transmutations of silver in 1908. In 1920, he published *La Fabrication Chimique de L'Or* to report his successes using both "wet" and "dry" methods of transmutation:

"By means of catalytic action I have succeeded in manufacturing gold chemically by acting on silver with arsenic and antimony sulfides, tellurium, and tin.

"This process gives a very high yield which has already been confirmed by several chemists, in particular by Mr. Ballandras, Chemical Engineer of Lyons, and Mr. Outon, Chemical Engineer of Buenos Aires...

"The object of the present leaflet is to enable chemists to repeat and check my experiments in their turn...

"I made a mixture composed of 3 gr. of chemically pure silver and 1 gr. of chemically pure orpiment and placed it in 36° [C] nitric acid for several months cold and then brought it to ebullition. The liquid was kept at the boiling point for several days. A small quantity of the material became detached at this moment and formed a pulvurent black deposit. When no further action took place, I decanted off the solution and collected the insoluble residue. This residue was attacked by aqua regia at the boiling point until it was almost completely dissolved; the liquor when decanted and filtered was analyzed and gave all the characteristic reactions for gold.... [December 1925]

"I acted on 22 gr. of chemically pure silver ... and on 3.5 gr. of chemically pure orpiment... The mixture was heated to about 1600° C. In a metal smelting furnace for about three quarters of an hour. The residue obtained was again melted with the addition of orpiment. After having hammered for half an hour and remelted with the addition of small quantities of orpiment every ten minutes, it was withdrawn.

"After cooling and the addition of chemically pure antimony sulfide, it was again put back into the furnace, small quantities of orpiment being thrown in every five minutes. The residue obtained had a dark metallic tint. After hammering it became slightly golden.

"The residue dissolved in chemically pure 36° nitric acid first cold and then hot, gave an abundant pulvurent deposit. This deposit after being washed and treated with ammonia to dissolve the arsenic and antimony salts was completely dissolved in aqua regia. The liquor then being chlorinated and filtered was subjected to the reagents of platinum and gold. Mr. Andre Vandenberghe who was acting as preparator for this experiment, had thought that in accordance with the law of the evolution of matter, the transmutation of bodies into gold should be preceded or accompanied by their transmutation into platinum...

"The reactions of gold were quite characteristic; the reactions of platinum also seemed to reveal its presence.

"The quantity of gold obtained in this experiment was about one gramme.

"I submit the hypothesis that the arsenic acts as a catalyst and the sulfur as a ferment in this transmutation." (December 1925; Douai, France)

All forms of Arsenic, including Orpiment (As disulfide), are extremely toxic. This effect has served well to preserve the secrets of Alchemy, simply by killing careless persons. Study the subject thoroughly before proceeding to the praxis.

"As a sequel to my previous work on the artificial synthesis of gold, I have introduced tin into these new tests as it is also often associated with gold in Nature. The following is a description of this new process, thanks to which the percentage of gold obtained destroys all the objections that are raised with regard to impurities.

"I made an intimate mixture of 6 gr of chemically pure silver... 2 gr of antimony sulfide, 1 gr of orpiment, and one gr of tin... I then added the usual fluxes and then heated the whole in a crucible in the furnace to about 1100° C. For about one hour, twice adding a small quantity of SbS.

"The residue obtained was treated for a long time in 36° nitric acid, first cold and then at the boiling point; the insoluble residue was next washed with distilled water, treated with ammonia, washed again and finally treated for a long time with boiling aqua regia.

"The liquor when filtered and subjected to the reagents of gold showed the presence of this metal in the form of abundant deposits which may be estimated at 0.05

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gr in all, which is very high considering the 6 gr of silver employed. The deposits when collected and dried had a yellow green metallic color and possessed all the characteristics of gold [Analytic tests confirmed the results]...

"The addition of tin to the other bodies has certainly facilitated the reactions of the gold and increased the yield of this metal which can be manufactured artificially by my process, i.e., by synthesis and in measurable quantities.

"It would be very easy to show that, given the respective prices of gold and of the other substances that are used in my process to produce it, a profit could be obtained if the process were worked industrially, all the more so as the greater part of the silver employed can be recovered at each test..

"I believe I now hold the key to the regular and even industrial manufacture of gold.

"But the industrial question is voluntarily put aside from my thoughts, for my only object is the search for pure scientific truth."

In a correspondence to Jollivet-Castelot, Mr. Ballandras reported on "How I Succeeded In Making Gold According To The Process of Mr. Jollivet-Castelot: Dosage of gold obtained by the second method ---

"From a mixture of 10 gr silver, 3 gr of tin, 3 gr of arsenic sulfide, and 3 gr of antimony sulfide, the residue which had been obtained was crushed as much as possible and subjected to a treatment of pure chloric acid like in the first method. However, in order to completely eliminate the silver and the tin employed, I scrupled to begin again the indicated treatments, that is as much to say that the powder which was obtained having been subdued first to the action of azotic acid, then washed with distilled water, then subdued to the action of chloric acid, then washed with distilled water, then once more washed with distilled water, and these different operations were begun once again with another portion of pure chloric acid... The insoluble residue was subdued to the prolonged action of aqua regia...

"It must be noted that this thing happened during the ebullition. The washed residue contained the slighter part of gold; this thing would be found dissolved in the last liquor which I obtained.

"After 18 hours of digestion at about 25°, I subdued the mixture to ebullition during 3 hours. After refrigeration, I filtered on glass wool and I looked if parts were not drawn along in suspense. I found nothing. Then, I decided to proceed to a circumstantial analysis of the liquor which I obtained...

"The quantity of gold which was obtained was 0.476 gr for 10 gr of silver employed, or 0.0476 gr of gold per gram of silver."

Jollivet-Castelot read this memorandum to the Academie Royal des Sciences (Belgium) on June 6, 1926:

"A Recent Experiment In Transmutation — All my research work on transmutation since 1908 has started from the fact that gold is found in nature associated with antimony and arsenic sufides as well as with tellurium, which is considered as a mineralizer of gold. I therefore considered that it was logical to introduce tellurium into the artificial combination of silver and arsenic and antimony sulfides that I make...

"I prepared a mixture composed of 6 gr of silver, 1 gr of native orpiment free of gold, 1 gr of antimony sufide and 2 gr of tellurium... I added pure silica to the usual fluxes. This mixture was heated in the furnace in the usual way for one hour at about 1100° C. The residue obtained was of a blackish-grey color with violet reflections. It weighed 6.42 grams.

"When subjected to the action of nitric acid, the residue was attacked with difficulty and greenish metallic particles became detached. The solution was then decanted and a greenish-yellow residue remained which was kept at the boiling point of nitric acid for several hours. After decanting off the liquor once again, the residue, which had not changed, was washed, treated with ammonia and then subjected to the action of boiling aqua regia in which it was entirely dissolved after boiling for several hours."

The solution was chlorinated and subjected to the reagents of gold with positive results, although, "A certain amount of gold was certainly lost in this test just as in all my previous tests, for it is known that arsenic, antimony, and tellurium entrain gold in their fusion and their volatilization.

"In order to obviate this disadvantage, I had thought of making the vapors of arsenic acid and antimony sulfides and of tellurium act on the silver in fusion in a closed vessel by means of a special device...

"I consider it certain that if the vapors were allowed to bubble through the melted silver, a much higher yield of gold would be obtained than that I have obtained hitherto by an imperfect and too rapid contact of the bodies in presence, while it is undoubtedly necessary to make them react on one another in the vapor state in a closed vessel."

Mr. Louis Outon, a pharmaceutical chemist in Buenos Aires, reported thus to Jollivet-Castelot in a letter (July 26, 1927):

"Dear Sir... I have repeated the experiments... in my laboratory and am amazed at the results. For the moment, it is only the scientific side which interests me, since the cost of the gold obtained is often greater than the value of the metal..."

Mr. A. Ballandras also replicated the experiments and reported the results:

"I will not conceal the fact that I have often heard ironical remarks about Jollivet-Castelot's processes by which he succeeded in manufacturing gold. I determined to check his tests with the greatest possible accuracy...

"In a new quartz crucible, I placed 15 gr silver, 6 gr arsenic sulfide, 6 gr antimony sulfide. The crucible was heated at a temperature of 500° C. And then for one hour and a half at 1100° C.. At this moment the mass was fairly liquid... The crucible was then allowed to cool down. The reddish-brown residue obtained weighed exactly 23.742 gr, or a loss of 3.258 grams.

"I allowed this residue to cool in pure nitric acid in which the greater part was dissolved fairly easily. After prolonged boiling the liquor was filtered on a new glass wool. The resultant liquor was very clear and absolutely free of any particles.

"The glass wool was then macerated in aqua regia rich in hydrochloric; after 18 hours maceration, the whole was boiled for 3 hours. I again filtered on glass wool in order to separate any traces of the filter from the liquor... Any gold that might have been obtained would necessarily be found in the last liquor... It was of importance to prove its existence qualitatively at least.

"For this purpose, I tried the various standard reagents, the results being the following: 1) Oxalic acid: flakey precipitate; 2) Iron sulfate: glossy metallic black; 3) Tin chloride: peach pink precipitate; 4) Formol: rather light bluish coloration; 5) Sodium carbonate, potassium carbonate: light coloration after boiling; 6) Sodium hydroxide, potassium hydroxide: yellowish coloration, cloudy.

"These reactions are sufficiently characteristic and clearly prove the existence in the last liquor of a metal which, even if it is not gold, must nevertheless be placed very close to the latter... the metal obtained and gold must be perfectly isotopic.

"I have repeated this test several times and I have observed: 1) That the production of gold is a function of the rapidity with which the necessary heat is obtained; 2) That it is also a function of the degree of tightness of the crucible. A crucible that is closed as tightly as possible gives better results; 3) That the amount of gold obtained was not always uniform; some of the tests were absolutely sterile and I inferred that this was due to some defect in the mounting.

"I think there must be a certain temperature that should not be exceeded and that the external conditions of pressure and

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electricity must be of considerable importance."

In another experiment, Ballandras used 10 gr silver, 3 gr tin, 3 gr orpiment, and 3 gr antimony sulfide: "After having operated as previously, I obtained a quantity of gold corresponding to 0.05 gr per gram of silver employed... This I consider to be a highly interesting result."

6. Dr. S. Emmens

Early in 1897, the British chemist Stephen H. Emmens, then residing in New York, announced the discovery of a new element which fills the "vacant space existing in the sub-group of Group I," and which he thought to be the intermediate matter from which silver and gold are formed. According to Dr. Emmens, "Our claim is that the element in question is therefore neither silver nor gold, but which may, by our new physical methods, be converted into gold."(14)

In 1897. Dr. Emmens' Argentaurum Laboratory on Staten Island produced over 660 ounces of gold from silver and sold it to the U.S. Assay Office. He revealed a few historical and technical details of his transmutation process in his book, *Argentaurum Papers #1: Some Remarks Concerning Gravitation:*

"Our work, which converts silver into gold, had its origin in the course of certain investigations which I undertook for the purpose of preparing chemically pure nickel... in 1892. In attempting to prepare these pure metals [nickel and iron], a certain product was obtained which seemed to differ from anything recorded in the textbooks. The same product was subsequently found when the investigation was extended to the case of metallic cobalt... The phenomena observed afforded indications of the existence of some substance common to the whole of the elements in what is known as Series 4 of Group 8 of the classification of Chemical Elements... It appeared to us almost self-evident that if we were right in supposing a common substance to be present in any single series of elements, the same would hold good for each group.

"And as Group I of the classification contains the precious metals — gold and silver — it was obvious that our time and attention should be directed to these metals rather than to any other....

"Our starting point, so far as silver and gold were concerned, was afforded by the remarkable discoveries of Mr. Carey Lea with regard to [colloidal allotropic silver]... It was found that... this subdivision of metallic silver was attended by very considerable changes in the physical properties of the substance... By certain physical methods and by the aid of a certain apparatus, we succeeded in bringing about a further subdivision of the silver. We were not surprised to find that the substance obtained differed so far from ordinary silver that it could no longer be regarded as the same elementary substance. It seemed to require a new name and a new chemical symbol. Inasmuch, therefore, as our theory was that this substance was common to both gold and silver, and in reality was the raw material out of which both gold and silver were constructed by the hand of nature, we named the substance Argentaurum...

"The next step was to ascertain whether this substance could be so treated as to be grouped into molecules of greater density than those of silver... We found that... Argentaurum can be aggregated into molecules having a density considerably superior to that of ordinary gold molecules. Whether we are right as to this or not, the condensed Argentaurum presents the appearance and is endowed with the properties of ordinary metallic gold...

"We do not consume any chemicals and other costly materials in our process; what we use is mainly energy in some of its various forms, such as heat, electricity, magnetism, gravity, cohesion, chemical affinity, x-rays and the like... Our chief source of expense is the time required for bringing about the desired molecular changes... One ounce of silver will produce three-quarters of an ounce of gold... (14)

Herbert Fyfe reported that Dr. Emmens' process comprised five stages: 1) mechanical treatment; 2) fluxing and granulation; 3) mechanical treatment; 4) treatment with a "modified nitric acid," and 5) refining. Dr. Emmens said, "I regard the mechanical treatment as the causa causans. The fluxing and granulation serve, I think, merely to render the molecular aggregate susceptible of displacement and rearrangement."(15)

The mechanical treatment was accomplished by means of Dr. Emmens' "Force Engine," which exerted pressures in excess of 500 tons/sq. in. at very low temperatures. Step 4, using "modified nitric acid," contradicts the statement made elsewhere, that "we do not consume any chemicals... in our process." (16-25)

In a letter (21 May 1897) to Sir William Crookes, Dr. Emmens included a sample of Argentaurum and these instructions:

"Take a Mexican dollar and dispose it in an apparatus which will prevent expansion or flow. Then subject it to heavy, rapid, and continuous beating under conditions of cold such as to prevent even a temporary rise of temperature when the blows are struck. Test the material from hour to hour, and at length you will find more than the trace (less than one part in 10,000) of gold which the dollar originally contained."

Sir Crookes was unable to replicate the experiment to his satisfaction. He reported that. "A specimen of Argentaurum sent me by Dr. Emmens has been examined with the spectrograph. It consists of gold with a fair proportion of silver and a little copper. No lines belonging to any other known elements, and no unknown lines, were detected." This analysis resembles that of ordinary bullion gold, which contains silver and copper to make it harder and more fusible than pure gold.

In a rejoinder, Dr. Emmens noted, "I have received a letter from a very eminent Fellow of the Royal Society informing me that he has performed the crucial experiment suggested in my letter of May 21, 1897, to Sir William Crookes. The gold contained in the Mexican dollar after 40 hours of intense cold and continuous hammering was found to be 20.9% more than the quantity of gold contained in the same dollar before the test."

In 1898, Emmens floated the Argentaurum Company, a syndicate which promised that for one ounce of silver (then worth about 50 cents) entrusted with payment of $4.50 per ounce for conversion costs, the investor would be repaid with 3/5 ounce of gold (then worth about $11). But Dr. Emmens' application for a patent on his process was refused, so production never began, since he would not have been able to protect his methods from unscrupulous competitors. (26-28)

Dr. Emmens was issued several U.S. Patents for inventions; at least two of them may be related to his process: USP # 501,996 (July 25, 1893), Electrolytic bath; USP # 501,997 (July 25, 1893), Apparatus for Electrolytic Extraction of Metals. Dr. Emmens' Force Engine produced hammering pressures in excess of 500 tons/sq. in. at very low temperatures. These effects can be achieved by a variety of modern methods.

Semantic ambiguities in Dr. Emmens' writings confuse the understanding of the process. At times, Argentaurum refers to a new element, or to the gold produced from it, or to Lea's intermediate allotropic silver.

7. Allotropic Silver

In 1889, Carey Lea discovered the preparation of allotropic silver while he was studying reductions of silver nitrate. He found that silver occurs in allotropic, intermediate, and ordinary forms. Ordinary silver is protean in nature. The aqueous solutions of allotropic silver are colloidal monoatoms, and give perfectly clear solutions. The several forms of allotropic silver (a-Ag) dry with their particles in optical contact with each other, thus forming continuous films which are beautifully colored,

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perfect mirrors. Strong acids and pressure will convert a-Ag to the normal form. There are three forms of a-Ag, and all are unstable.[29, 30]

There is also a very stable "intermediate form" of silver (i-Ag) which is easy to prepare. It occurs as bright gold-yellow or green crystals with a metallic luster. Treatment with a very dilute solution of ferric chloride will enhance the appearance of its foliar structure, interpenetrating with plant-like ramifications, or sheafs of fine acicular crystals up to 1 inch long.

Intermediate silver is hard, tough, and unaffected by pressure. It is nearly as indifferent to oxidizing and chlorizing agents as is normal silver. Intermediate silver can be formed from the allotropic varieties by light, heat, or chemical action. The simplest preparation is as follows:

"It has long been known that golden-yellow specks would occasionally show themselves in silver solutions, but could not be obtained at will and the quantity thus appearing was infinitesimal. Probably this phenomenon has often led to a supposition that silver might be transmuted into gold. This yellow product, however, is only an allotropic form of silver, but it has all the color and brilliancy of gold, a fact which was apparent even in the minute specks hitherto obtained...

"It is a little curious that its permanency seems to depend entirely on details in the mode of preparation. I have found many ways of obtaining it, but in a few months the specimens preserved changed spontaneously, to normal silver... The normal silver produced in this way is exquisitely beautiful. It has a pure and perfect white color like the finest frosted jewelers' silver, almost in fact exceeding the jeweler's best products. I found, however, one process by which a quite permanent result could be obtained... the following proportions give good results:

"Two mixtures are required: No. 1 containing 200 cc of a 10% solution of silver nitrate, 200 cc of 20% solution of Rochelle Salt [Sodium potassium tartrate] and 800 cc of distilled water. No. 2, containing 107 cc of a 30% solution of ferrous sulfate, 200 cc of a 20% solution of Rochelle salt and 800 cc of distilled water. The second solution (which must be mixed immediately before using only) is poured into the first with constant stirring. A powder, at first glittering red, then changing back to black, falls, which on the filter has a beautiful bronze appearance. After washing it should be removed whilst in a pasty condition and spread over watch glasses or flat basins and allowed to dry spontaneously. It will be seen that this is a reduction of silver nitrate by ferrous sulfate...

"Although the gold-colored silver (into which the nitrate used is wholly converted) is very permanent when dry, it is less so when wet. In washing, the filter must be kept always full of water; this is essential. It dries into lumps exactly resembling highly polished gold...

"If we coat a chemically clean glass plate with a film of gold-colored allotropic silver, let it dry, first in the air, then for an hour or two in a stove at 100°C., and then heat the middle of the plate carefully over a spirit lamp, we shall obtain with sufficient heat a circle of whitish gray with a bright, lustrous golden ring round it, somewhat lighter and brighter than the portion of the plate that has not been changed by heat. This ring consists of what I propose to call the 'intermediate form'...

"With sulfuric acid diluted with four times its bulk of water and allowed to cool, an immersion of one or two seconds converts a film on glass or on pure paper wholly to the intermediate form...

"Its properties are better seen by using a film formed on pure paper, one end of which is heated over a spirit lamp to a temperature just below that at which paper scorches. The change is sudden and passes over the heated portion of the surface like a flash. Examining the changed part, we find:

1st. That it has changed from a deep gold to a bright yellow gold color.

2d. When subjected to a shearing stress *it does not whiten or change color in the slightest degree.*

3d. It is much harder, as is readily perceived in burnishing it.

4th. It no longer shows the color reaction with potassium ferricyanide and ferric chloride, changing only by a slight deepening of color.

"Of these characteristic changes the second is the most remarkable. The gold-colored silver in its original condition changes with singular facility to white silver; almost any touch, any friction, effects the conversion...

"The intermediate form is distinguished from normal silver almost solely by its bright yellow color and its higher luster."

8.References

1. Tiffereau. T.: *Les Metaux Sont Des Corps Composes*; Vaugirard (Paris, 1855)
2. Tiffereau, T.: *L'Or et le Transmutation des Metaux*
3. Tiffereau, T.: *Comptes Rendu Acad. Sci. Paris* 38: 383, 792, 942 (1854); ibid., 39: 374, 642-644, 743, 1205 (1854); ibid., 40: 1317 (1855); ibid., 41: 647 (1855); ibid., 123:1097 (1896)
4. Baskerville, C.: *Popular Science Monthly* 72: 46-51 (1908)
5. Waite, A.E.: *A Collection of Alchymical Processes*; S. Weiser (New York, 1987)
6. Fulcanelli: *Les Demeures Philosophales*, vol. 1, p. 184-185, 189-200; J. Pauvert (Paris, 1964)
7. "A.A.E.": *Nature* 121 (# 3060), p. 981 (June 23, 1928)
8. "A.C.": *Chimie et Industrie*, (1927), Suppl. 18/19 (4).
9. Anonymous: *Rev. Ind. Chimie Industrielle* 37: 63 (1928)
10. Jollivet-Castelot, Fr.: *Chimie et Alchimie*; E. Noury (Paris 1928)
11. Jollivet-Castelot, Fr.: *La Fabrication Chimique de L'Or* (Douai, 1928)
12. Jollivet-Castelot, Fr.: *L'Hyperchimie* (Paris, 1896-1901)
13. Jollivet-Castelot, Fr.: *La Synthese de L'O*; H. Daragon (Paris, 1909)
14. Bolton, H.C.: *Chemical News* 76: 61-62 (6 August 1897)
15. Fyfe, H.C.: *Pearson's Magazine* (March 1898)
16. Gaddis, V.H.: *American Mercury* 86: 65-69 (January 1958)
17. Fletcher. E.A.: *Frank Leslie's Popular Magazine* (March 1898)
18. Anonymous: *The Arena* (Boston), p 139-140 (1898)
19. MacKenzie, J.: Spokane Mines & Electrician (17 February 1897)
20. Emmens, Dr. S.H.: *Chemical News* 76: 117-118 (3 September 1897)
21. Emmens, Dr. S.H.: Science 5 (113): 343-344 (26 February 1897)
22. Emmens, Dr. S.H.: *Argentaurana* ; G. Du Boistel (Bristol, 1899).
23. Emmens, Dr. S.H.: *Science* 7 (168): 97 (November 1898)
24. Emmens, Dr. S.H.: *Arcanae Naturae* (Paris, 1897)
25. Emmens, Dr. S.H.: *Argentaurum Papers #1: Some Remarks Concerning Gravitation*; Plain Citizen Publ. Co. (New York, 1896)
26. Ord, W.E.: *Knowledge* 20: 285 (1 December 1897)
27. Woodward, Dr. R.S.: *Science* 5 (112): 343-344 (19 February 1897)
28. Young, C.A.: *Science* 5 (113): 343-344 (26 February 1897)
29. Lea, Carey: *Amer. Sci. J.* (Series 3) 37 (222): 476-491 (June 1889); ibid., 38 (223): 47-50 (July 1889); ibid., 38 (224): 129 (August 1889); ibid., 38 (225): 237-241 (September 1889); ibid., 41 (243): 179-190 (March 1891); ibid., 42 (250): 312-317 (October 1891); ibid., 48 (148): 343 (October 1894); ibid., 51 (24): 259-267 (April 1891); ibid., 51 (246): 282-289 (April 1891).
30. Lea, C.: *Zeit. Anorg. Allgem. Chem.* 7: 340-341 (1894)

The Ohsawa-Kushi Transmutations

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Nuclear physicists bombard targets with high-energy particles in order (or chaos) to prove the schematic of their mindset with appropriate experimental results. In recent years, however, the discovery of cold fusion has quite upset the world view of conventional physicists, who generally deny the possibility that Nature allows for other means of transmutation. Yet, there is considerable historical evidence that many types of transmutations have been accomplished without particle accelerators, long before Pons and Fleischmann announced their discovery of cold fusion. There is so much credible documentation of low-energy transmutation that, in the words of Rupert Gould, "did it relate to any more probable event, we should be compelled either to accept it or cease putting any faith in recorded testimony."

Among the many examples that can be cited, "biological transmutation" is the best

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developed and well-known. About forty years ago, Dr. Louis Kervran presented the idea that sodium, potassium, and dozens of other elements change into each other under certain natural conditions in the mineral, vegetable, and animal kingdoms. Biological transmutations have been demonstrated, crucial experiments replicated, and the theoretical principles verified by many scientists who are finding new industrial, medical and agricultural applications of the discoveries.

Inspired by the pioneering work of Dr. Kervran, Dr. George Ohsawa sought to transmute sodium into potassium *in vitro*. The method revealed itself to him in a symbolic dream. Thus inspired, Dr. Ohsawa and Michio Kushi, *et al.*, constructed an experimental electric discharge tube with copper (Yin) and iron (Yang) electrodes and a valve through which to draw a vacuum or admit oxygen (Fig. 1). The first transmutation with this equipment was achieved on June 21, 1964. After applying 60 watts of electricity for 30 minutes to heat sodium to a plasma, a molar equivalent of oxygen was introduced. Viewed with a spectroscope, the orange band of sodium gave way to the blue of potassium, according to the formula:

$$Na^{23} + O^{16} = K^{39}$$

Analysis of the reaction product confirmed the result and revealed an unexpected extra: a trace of gold was produced by the combination of Na, O, and K with the Cu and Fe electrodes. Several different metals were tested as electrode materials. Neon and argon atmospheres were found to enhance the yield of potassium and other elements. External heating of the reaction tube also served to ionize the sodium.

In his book *Transmutations A Faible Energie*, Louis Kervran mentions that "Professor [Masashiro] Torii, on a circuit designed by Prof. Sakurazawa, and under the control of Prof. Odagiri, observed in the spectroscope the passage of sodium to potassium upon the adjunction of a small quantity of oxygen to sodium vapor...

"Prof. Torii [of Musashino Institute of Technology, Tokyo] has informed me of having observed on 21 June 1963, in the spectroscope, the passage of sodium to potassium, the disappearance of the yellow line of sodium being replaced by the red-violet ray of 7699 A potassium; the experiment was repeated June 22 before five scientists."

Dr. Louis Kervran also cited the example of, "in the production of steel in electric furnaces, the incomprehensible appearance of boron. We see now that we cannot exclude, under the effect of a powerful electric field and of the high temperature of these furnaces, the 'reproduction ' of carbon from the loss of hydrogen and in keeping with: C - H = B."

Dr. Kervran recommended the following experiment: "The experience is simple to realize, as it suffices to take a plate of steel — or of iron — an anode of magnesium, place them in a jar containing distilled water rendered conductive by a salt of magnesium — in order not to introduce any metallic ion other than magnesium, and these two electrodes are reunited by a metal wire, to the exterior of the jar; thus they realize (in part) a battery with magnesium at the negative, iron as positive; through the production of hydrogen at the electrode, magnesium is at a potential of 1.9 volts more negative than iron. Leave it for two or three months; from time to time add a little distilled water in order to compensate for evaporation. On analysis, calcium is obtained... in an operation in which calcium was not introduced!"

The calcium (as oxide) accumulates in scales on the cathode. Kushi and Ohsawa, et al., proceeded to develop their process for industrial-scale production. They estimated that potassium could be manufactured for 1% of the current price. In a correspondence to Ken Jones (12 October 1980), Michio Kushi stated that, "After George Ohsawa and myself succeeded in producing K out of Na and O... we presented the experiment to several chemical corporations. At that time, Pfizer International became most actively interested. We had conferences on several occasions; however, soon after we decided not to become involved with these corporations, as a result of the considerations of the vast effects this would have on the industry." The researchers also had no patent with which to protect their interests.

Ohsawa and Kushi then turned their attention to the manufacture of steel by transmutation of carbon and oxygen according to the formula:

$$2(C^{12} + O^{16}) = 2\ Si^{28} = Ni^{56} = Fe^{56}$$

The experimental arrangements worked as predicted, and produced several other elements from combinations of C and O with atmospheric nitrogen, etc.. Strangely, "the Fe produced by this transmutation is stainless; it does not rust easily. Also it reacts much less to heat than does ordinary Fe... All results of the transmutation for Fe have been carefully examined and analyzed by several methods, as: (1) magnetic inspection, (2) spectroscopic analysis, (3) chemical analysis, (4) examination by reagents, etc., and confirmed by authoritative testing agencies." The new form of iron was called GOS (George Ohsawa Steel). The experimental method is as follows:

"*Method 1*: Transmutation in Air [Fig. 2] — Two graphite crucibles (approx. 2.5" x 5") cover each other top and bottom. The upper crucible has a 10 mm. Hole, surrounded by a ceramic ring, which acts as an insulator. Into this hole a carbon rod (0.25" diam.) is inserted until it reaches the 2 or 3 grams of carbon powder placed at the bottom of the lower crucible, which has one or two small holes at the lower part of its side wall for circulation of air. An iron base placed under the lower crucible acts as another electric pole. As the carbon rod approaches the powder, the electric arc arises. Continuing the operation for 20 to 30 minutes, the carbon powder changes to iron. In this experiment, the applied electricity is about 35 to 50 volts, and 8 to 18 amps, either AC or DC.

"*Method 2*: Transmutation in Water — Using two carbon rods (0.25" diam.), create an electric arc between them, striking them on one another in water. This operation is performed for 1 to 5 seconds. Then, brown-black metallic powder (which contains iron) falls down to the bottom of the water.

"Method 3: Transmutation in Air — Carbon powder is placed on a copper plate, approximately 12" long, 6" wide, and 0.5" thick. This plate works as an electrical ground. A carbon rod (0.25" diam.) used as the other electrical pole, is struck repeatedly to the carbon powder on the plate, producing an electric arc. The carbon powder changes into iron.

"During the process of this transmutation, nickel is temporarily produced as a short-lived radioactive isotope. The degree of transmutation from C and O is approximately 5% to 20% immediately, with a larger percent of transmutation occurring gradually in the air, which has the effect of cooling the metallic powder to below room temperature."

In another experimental configuration (Fig. 3), the reaction was cooled by dry ice. When sparked with carbon rods, the CO_2 vapors also yielded iron, etc..

In 1994, R. Sundaresan and J.Bockris (Texas A & M) reported that they had observed "Anomalous Reactions During Arcing Between Carbon Rods In Water:

"Spectroscopically pure carbon rods were subjected to a carbon arc in highly purified water. The arc current varied from 20 to 25 A and was passed intermittently for several hours. The original carbon contained ~ 2 ppm Fe. The C rods remained cool to the touch at >2 cm from their tips. Adsorption of iron from water or the surrounding atmosphere was established as not being the cause of the increase of iron. There is a weak correlation between the

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iron formed and the time of passage of current.

"When dissolved O_2 was replaced by N_2 in the solution, no iron was formed. Hence, the mechanism

$$26C^{12} + 28O^{18} \rightarrow 26Fe^{56} + 2He^{4}$$

was suggested as the origin of the iron. The increase in temperature of the solution was consistent with expectation based on this reaction."

Also in 1994, another group of researchers (M. Singh, et al.) at the Bhabha Atomic Research Centre (Bombay) reported "Verification of the G. Ohsawa Experiment for Anomalous Production of Iron from Carbon Arc in Water:

"A direct current arc was run between ultrapure graphite electrodes dipped in ultrapure water for 1-20 hours. The graphite residue collected at the bottom of the water trough was analyzed for Fe content by a conventional spectrographic method... The Fe content was fairly high, depending on the duration of the arcing... The results showed large variations in Fe content (50 to 2000 ppm) in the C residue. In the second series of experiments... with the water trough fully covered, the amount of Fe in the carbon residue decreased significantly (20-100 ppm). Here also there were large variations in the iron concentration in the residue, although the experiments were performed under identical conditions. Whether Fe is really being synthesized through transmutation from C and O as suggested by George Ohsawa or is getting concentrated to different degrees through some other phenomenon is not currently clear. The Fe in the C residue was also analyzed by mass spectroscopy for the abundance of various isotopes... Besides Fe, the presence of other elements like Si, Ni, Al, and Cr was also determined in the C residue, and it was found that the variation of their concentrations followed the same pattern as that of Fe."

In 1996, Kenjin Sasaki reported his successful experimental replication of the carbon arc production of iron. He used a 99.9999% pure graphite crucible and rod with a 100V/10A electric welder. The crucible was cooled. The arc (8-10A) struck high-purity carbon powder 4 times for 1 minute each time. The yield of iron was recovered with a magnet. Further experiments conducted by C. Akbar (Kushi Research Institute) "indicate that voltage potential and current density are important in the formation of iron in chemically pure carbon."

Toby Grotz also conducted this experiment and reported the results in detail in 1996. He tested activated charcoal, activated carbon, and coal. No iron was produced from charcoal, but activated carbon did yield magnetic material. Tests were performed with copper and aluminum plates and rods to eliminate the possibility that the carbon rod and copper plate might be releasing iron. Analysis of the results showed that, "This amount [0.22 gram] of iron is an order of magnitude less than that which occurs naturally in the sample... The excess weight appears to be due to magnetic material that is part of or encased in particles of carbon... [T]here is a point at which no more magnetic material may be removed from the sample using the arc discharge process. It is proposed here that the high current density of the arc discharge magnetizes magnetic material that exists within the particles of the activated carbon. This then allows separation of the magnetic material from the sample using a magnet.."

J. Bockris and associates replicated the experiment using the underwater arcing method, and found only microgram amounts of iron after 24 hours. When the experiment was repeated with the reaction vessel covered to exclude air, no iron was found.

Those results prompt this writer to suggest that at least some of the reported yields of iron might be due to the arc coagulating ORMEs (Orbitally Rearranged Monoatomic Elements) existing in the Earth's atmosphere. ORMEs are virtually undetectable by all conventional methods except infrared analysis, which can distinguish a certain characteristic doublet. As David Hudson discovered in the 1980s, ORMEs can be converted to metallic form by certain processes involving carbon or nitrogen, which are used to insert an electron in the d orbital shell of the atoms. The complete process is described in his Australian patent (available on the Internet).

Dr. Joseph McKibben has published his suggestion that the transmutative production of iron from carbon may be due to what he calls a subquark particle, which has a mass of about 1.15 nucleons. McKibben states that the subquark, "when attached the ^{4}He seemed to me to be an ideal candidate for an ideal catalytic agent," which he goes on to explain in detail.

In the 1980s, Michio Kushi resumed his experiments with the "aim of finding methods of mass production... At that time I shall be able to consider how to present to the world the transmutation of the atom using the principles of Yin and yang for the future world industry.

"The transmutation of the atom can be achieved if elements are changed into the state of plasma, and if these elements are well understood in their antagonistic and complementary relations to other elements, according to the principles of Yin and Yang.

"The atomic number, mass, density, and gravity, physical reaction to temperature such as melting and boiling points, chemical reactions to other elements, reactions to specific environmental factors, such as ultraviolet and infrared wavelengths applied to the elements, as well as spectroscopic color analysis— all of these characteristics of the atom can contribute to classify the atom into the Yin group or Yang group...

"Nothing is solely Yin or Yang: everything involves polarity. There is nothing neuter. Either Yin or Yang is in excess in every occurrence. Large Yin attracts small Yin; larger Yang attracts small Yang. At extremes, Yin produces Yang, and Yang produces Yin. All physical forms and objects are Yang at the center and Yin at the surface."

In accordance with this Taoist atomic theory, "Hydrogen, the center of the atomic spiral, is Yang. It gathers particles to itself, forming the first octave of creation. The conditions become apparent upon studying the melting and boiling points of the first eight elements.

"Within the first octave, the greatest attraction is between carbon and oxygen, which represent Yin and yang respectively. It is the fugate interaction of these two that form the other elements. Carbon is often replaced by boron. In terms of Yin and yang, these are like brothers in that they react in similar ways in forming new elements."

Since the initial experiments were conducted by George Ohsawa and Michio Kushi in the 1970s, several other researchers have reported the same results and more, thanks to modern analytical equipment, computers, and communication. The worlds of low-energy transmutations have become much more accessible to us. New discoveries (cold fusion and biological transmutations espe-

Classification	Yin	Yang
Tendency	Expansion	Contraction
Position	Outward	Inward
Structure	Space	Time
Color	Purple	Red
Temperature	Cold	Hot
Weight	Light	Heavy
Catalyst	Water	Fire
Atomic	Electron	Proton
Elements	K, O, P, Ca, N	H, As, Cl, Na, C

The Fugate of Carbon

1 (C + O) = Si	5 (C + O) = Ce
2 (C + O) = Fe	6 (C + O) = Er
3 (C + O) = Kr	7 (C + O) = Pt
4 (C + O) = Cd	After Pt the elements become increasingly Yin

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cially) are being reported at an increasing rate in the scientific literature. Some inventors already claim to be producing rare elements in bulk. Perhaps within a few decades we shall see the mass production of elements on demand...

References

1. Anonymous: *The Order of the Universe* 3(10): 12, 14-17.
2. Gardiner, Bruce: *East-West Journal* (February 1975), p. 15.
3. Harris, P.M.: Unpublished lab notes (March 1965).
4. Kervran, Louis: *Transmutations A Faible Energie*; 1964, Libr. Maloine, Paris;
ibid., *Preuves Relatives A l'Existence de Transmutations Biologiques* (1968);
ibid., *Transmutations Biologiques en Agronomie* (1970);
ibid., *Biological Transmutations*; 1972, Swan House, NY, &c...
5. Kushi, Michio: *East-West Journal* (February 1975), pp. 22-26.
6. Kushi, Michio: *Kushi Institute Study Guide* # 10: "Atomic Transmutation".
7. Mallove, E.: *Infinite Energy* , March-April 1996 (#7).
8. Sundaresan, R. & Bockris, *J.: Fusion Technology* 26: 261 (Nov., 1994).
9. Singh, M., et al.: Fusion Technology 26: 266 (Nov., 1994).
10. Ohmori, T. & Enyo, M.: *J. New Energy* 1(1):15-22 (1996).
11. Grotz, T.: *Fulcrum* 4 (3):6-10 (Oct., 1996).
12. McKibben, Joseph L.: *Infinite Energy* #11 (Nov.-Dec. 1996), p. 37

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FIGURE 1
Na + O → K

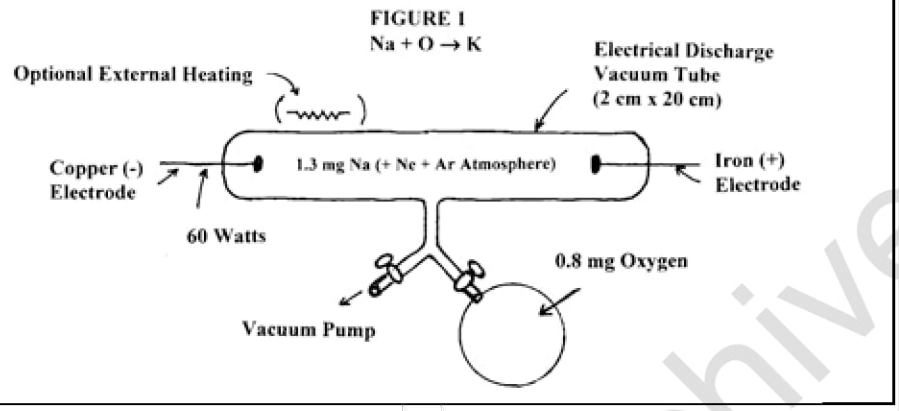


FIGURE 2
2 (C + O) → Fe

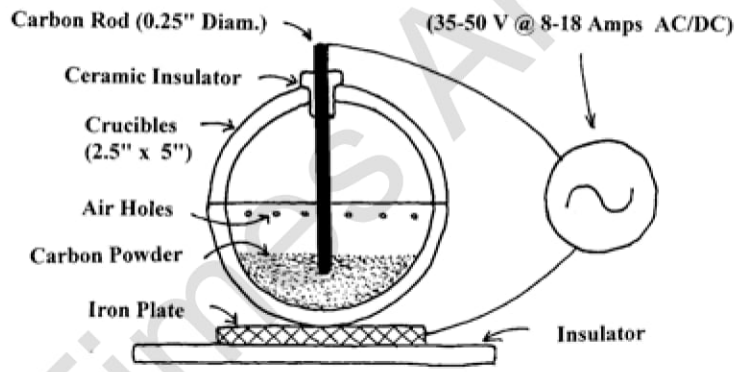
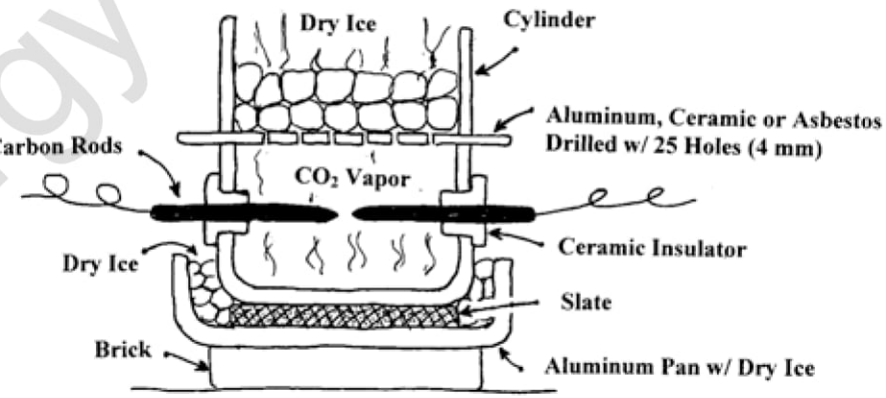


FIGURE 3
2 (C + O) → Fe



Reaction Time: 15-30 Minutes

(15-30 Volts DC @ 17-20 Amps)

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A Unity Engine

by Kenneth M. Rauen

The field of alternative energy has blossomed from traditional technologies such as photovoltaics, wind and water power, to over unity (OU) energy technologies such as new hydrogen energy, magnetic motors, water cavitation, pulsed abnormal glow discharge, and others.

There is another category of alternative energy that fits neither grouping. It is not OU and it taps a known energy source. Like OU devices, it is a surprise to modern physics and engineering. Unlike OU, the seeming clash with modern physics is almost entirely explainable within present theory. It is simply an oversight and could have been developed 100 years ago. It is an "external combustion" heat engine operating on a new thermodynamic cycle.

Heat engines are not thought of as having a role in a clean energy future as a primary energy source, only as a secondary means to utilize stored, clean energy. A heat engine can be a mainstream alternative energy source. Imagine the seemingly impossible condition of a heat engine that taps the thermal energy content of the atmosphere or oceans on demand and with multigigawatt capability! It is possible. To do this, a heat engine must have an efficiency exceeding Carnot's Theorem or even approaching unity. Since any new development is best accomplished through the efforts of many, this new concept is being shared in a general form to stimulate communication, collaboration, and to open a whole new area of exploration in thermodynamics.

It is possible for some heat engines to exceed Carnot and, under reversible conditions, to be unity efficient. The concept has had some very limited peer review in academia. The response has been that this is a fantastic concept, but it flies in the face of modern physics. Yet no one has identified a specific error in the design, nor has anyone refuted experimental data. The only errors cited are generalities such as violating Carnot's Theorem or the Second Law of Thermodynamics.

Max Planck once said, "We have no right to assume that any physical laws exist, or if they have existed up to now, that they will continue to exist in a similar manner."[1] He meant that our understanding of the physical laws of the universe are susceptible to change.

Misunderstandings of the Second Law of Thermodynamics and Carnot's Theorem must be cleared up. The Second Law has never been proven.[2] It is merely a statement of collective experience about the flow of energy, specifically in reference to entropy, a description of randomness and also a thermodynamic state variable defined as heat divided by absolute temperature. The Second Law of Thermodynamics can be most accurately stated as, "If an isolated system undergoes change, it will change in such a way that its entropy will not decrease." This is not a new interpretation of the Second Law; it is in use already.[3] What needs to be rectified are the prolific uses of the Second Law which demand that all real systems have entropy increases, which lead to engineering axioms such as, "It is impossible to construct an engine that, operating continuously, will produce no effect other than the extraction of heat from a single reservoir and the performance of an equivalent amount of work," or "It is impossible to construct a device that, operating continuously, will produce no other effect other than the transfer of heat from a cooler to a hotter body."[4] These statements do not apply when entropy changes are zero. Prigogine's Nobel Prize-winning work shows that entropy can decrease spontaneously under some conditions. Prigonine's examples may not have had truly isolated energy systems to define the total, absolute energy exchange, but they clearly point to practically closed systems that did decrease entropy. This paper gives other reasons to believe that some energy transfer systems can achieve or approach zero entropy increases which will allow us to tap the thermal energy of the surface of the earth.

Imagine the seemingly impossible condition of a heat engine that taps the thermal energy content of the atmosphere or oceans on demand and with multigigawatt capability! It is possible.

The Second Law states that energy must be added to a system to make heat flow "uphill" or to make heat flow in a thermally equilibriated system. The Second Law does not say how much energy must be added. Instead of an energy input which must be equal to or greater than the absolute temperature increase as stipulated by Carnot, the energy input just merely needs to exist to satisfy the Second Law under irreversible conditions. Reversible conditions allow this input to approach zero.

Carnot's Theorem is more demanding than the Second Law, as it does define how much energy is required or can be produced from an engine, as a ratio of the absolute temperatures involved. Carnot's Theorem boils down to this:

$$\text{maximum engine efficiency} = (T_{in} - T_{out})/T_{in}.$$

Carnot is part of the Second Law but the Second Law is not Carnot. This distinction should be clear. Carnot is derived from the Kinetic Theory of Gases (KTG) and refers to thermal phenomena. Entropy and thermal energy are separate topics.

The KTG is the fundamental model of the nature of heat. The KTG states that gas particle collisions are elastic and that thermal energy is proportional to the average particle kinetic energy. This energy is a function of absolute temperature and the range of these particle energies is a statistical grouping known as the Boltzmann distribution. Though the model is most appropriate for gases, it applies to all forms of matter. The transfer of thermal energy depends totally on this distribution of the thermal energy in the matter. Only a portion of the thermal energy can be transferred, strictly determined by the absolute temperatures involved. Carnot's Theorem is based upon these assumptions. Any phenomenon which does not conform to the KTG is not bounded by Carnot. Appropriately, Carnot only applies to strictly thermal processes. Classical heat engines are comprised of only thermal processes and are Carnot limited.

Nonthermal processes can be part of a heat engine. (Specific examples will not be given at this time as they are the essence of the author's inventions.) By definition, a heat engine is any device which produces work from heat. Work can take the form of mechanical, electrical, or chemical energy. Carnot cannot define the maximum possible efficiency when part of an engine cycle is nonthermal. The reader can begin to understand that Carnot does not limit the efficiency of all heat engines. Remember that Carnot describes thermal phenomena, not entropy. Carnot becomes a maximum limit for thermal processes as a result of entropy by the Second Law.

It is a big jump from exceeding Carnot to the idea that a heat engine can convert all of its heat input into work. Unity efficiency

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is mind-boggling, but remember that other energy devices come close. Photovoltaics, though only about 10% efficient with the solar spectrum, have conversion efficiencies approaching unity with monochromatic radiation at the cell's photoelectric potential. They are nonthermal and are not Carnot limited. Fuel cells do not convert energy by thermal means and therefore are not Carnot limited. Fuel cells produce much higher efficiencies than a classical heat engine when powered by the same fuels which release the same energy. Why this difference exists is the key to a better heat engine cycle.

Unity efficiency of heat engines is supported by six phenomena. The first is the interaction of all physical laws. The KTG contains the second. The interaction of heat with different forms of energy is the third. The nature of expansion processes is the fourth. A classical form of energy is the fifth. The sixth is a direct comparison to a familiar phenomenon.

Not only does Carnot's Theorem have limited applicability, but just like any other physical law, Carnot can be superseded by another law. Venturi's principle supersedes the effect of gravity in an airplane. This new heat engine does not violate Carnot any more than an airplane violates gravity. The principles which break the Carnot barrier coexist with Carnot just as gravity keeps an airplane from soaring into the stratosphere. Carnot is valid and yet it is compatible with unity efficiency.

For the second reason, the KTG states that gas particle collisions are elastic. Thermal energy is not lost from the particle collisions, nor does heat degrade to another form of energy. Its state is perpetual. The KTG implies there is no inherent entropy change in thermal processes! The Second Law as quoted above agrees with this. We must change our understanding of the Second Law to be consistent in our science

Most forms of energy spontaneously degrade to heat. Heat only degrades when there is a lower temperature thermal reservoir for the heat to flow to, and it remains as heat. Heat seems to be the lowest form of energy, but it is not. It spontaneously transforms to work in heat engines. It also spontaneously transforms to electromagnetic radiation, which is the nature of "black body" radiation. Since heat goes into an engine, partly converts to work, then totally converts back to heat, it appears that heat is a very stable form of energy.

If a heat engine takes heat from the environment, converts it to work, and the work ultimately degrades back to the environment in the same condition from which it came, isn't this implying that thermal energy does not have to degrade and is self sustaining? It insinuates heat has a quality that is not exhausted and needs not be replenished. It implies that heat can go through many transformations and not increase its entropy. At absolute zero the atom still has motion of its electrons; is this perpetual motion? It is reality. Maybe perpetual motion is a part of the physical universe and that energy in the form of thermal energy can be tapped by heat engines.

The third phenomenon in support of unity efficiency is that once heat is converted to work, that energy no longer has a temperature reference. When it converts back to heat, its temperature can be whatever the material temperature is in which the work is transformed into heat. It is possible for heat to transform to work and to go back to heat at the same or higher temperature.

The fourth phenomenon is the thermodynamic nature of expansion. Expansion processes are inherently capable of expanding to subambient temperatures. Compressed air at ambient temperature which is vented through a valve becomes cold. This is a form of adiabatic expansion, the type of expansion most often used in engines. Expansion creates an internal heat sink in an engine which allows heat to flow to the engine. If the engine operates below ambient temperature, the engine can tap the ambient thermal energy of the environment to do work.

Existing technology can support the subambient expansion concept. The process of fractionating air into its component gases by cryogenic condensation, known as the Linde process, has been improved by the addition of a turbine expander into the subambient gas stream. This expander demonstrates a common thermodynamic principle in an uncommon application. The application is so uncommon as to elicit a response from engineers off the top of their heads that it is impossible: the expander simultaneously produces work output and "refrigerates" the working fluid. Think about it. A turbine inlet receives a "hot," pressurized gas and exhausts a "cold," depressurized gas and produces work. What throws the classical engineer off track is the concept of extracting work from an expander and simultaneously producing refrigeration. Everyone knows the Second Law requires refrigeration to have energy input and denies the possibility of energy output. The expander assisted Linde process does have net energy consumption, but it is nonetheless remarkable that one step of the process is capable of work extraction from an expanding gas and simultaneous generation of a chilled gas stream at subambient temperature. What is important about this example is that the expansion process is inherently capable of what a "cold engine" needs. The expansion process does not lift heat up in temperature, so it is not a true refrigerator. It only converts some of the heat content of the gas to work, thereby cooling the gas, irrespective of the expander's thermal surroundings.

Unfortunately, expansion is not a complete cycle. How to form a complete cycle with subambient expansion is a challenge to be met. The answer is buried in phenomenon number five, to follow momentarily.

There is more to the expansion concepts. Adiabatic expansion is found in the Rankine, Brayton, Otto, Diesel, and Carnot cycles, among others. The maximum possible work from adiabatic expansion is

$$W_{max} = m\,(T_{max} - T_{min})\,C_v,$$

where m is mass and C_v is heat capacity at constant volume. Adiabatic expansion is Carnot limited, as defined by the absolute temperatures in the equation.

Adiabatic expansion is the most common method of producing work, but by no means the only one. Isothermal expansion is found in the Stirling cycle. Isothermal work is dependent upon pressure and volume,

$$W_{max} = (P_1)\,(V_1)\,\ln\,(V_1 / V_2).$$

Any set of P and V is a function of absolute temperature T as given by the Ideal Gas Law,

$$PV = nRT,$$

where n is the number of moles of a gas, and R is the gas constant. Note that PV has units of energy. Ideally, the internal energy of the working fluid, U, does not change; delta U equals zero. When chemical, kinetic, and potential energy are not involved, internal energy is just thermal energy or sensible heat. All heat added during isothermal expansion is converted to work when delta U equals zero. This is 100% conversion of heat to work. Since delta T is zero for isothermal expansion processes, Carnot dictates no work can be produced, yet isothermal expansion does produce work. Isothermal processes exceed Carnot. So, here we see that heat is able to transform to and from work without the limitations of Carnot. This paradox is explainable. Since the thermal energy of the working fluid does not change under reversible conditions for an ideal gas and the heat only interacts with work which has no temperature reference, Carnot does not apply to isothermal processes. Under irreversible conditions, some thermal energy

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changes, but some energy changes nonthermally, so Carnot still does not apply.

Why is the Stirling cycle Carnot limited if isothermal processes are not? The cycle is limited because isothermal compression consumes most of the work generated. The work generated and consumed are both proportional to the absolute temperatures of the working fluid as shown in the Ideal Gas Law. The amount of isothermal work that a given quantity of fluid can do is directly proportional to its absolute temperature though all transferred heat converts to and from work.

The fifth unity booster is Gibbs Free Energy (GFE) transformations. We are so accustomed to thinking of only enthalpy changes for engine processes that this simple observation becomes a paradigm shift. As stated before, specific examples will not be cited as they define the author's inventions. It is incumbent upon the readership to see the general concept and find hard examples themselves. Besides, this avoids myopic repetition which can stifle advancement. GFE engine processes blow the field of thermodynamics wide open. GFE is what allows fuel cells to outperform classical heat engines. The engine processes which support subambient expansion must be GFE driven in order to have advantageous energy and entropy changes, and to complete a cycle. Look to chemical engineering for ideas.

The essential difference between GFE and thermal energy is fixed, quantized energy transitions versus proportioned, statistically variable transitions. Quantized energy transitions call for the same energy to be exchanged with every particle that undergoes change. Like chemical reaction in a fuel cell, or like photon absorption in a solar cell, a specific amount of energy is required to make the transition for each and every particle, or else it will not happen. Quantized transitions are "all or nothing," unlike statistical transitions which are proportioned by ratios of absolute temperature.

Spontaneity is defined by GFE. The Gibbs free energy change in a reaction or change of state is defined mathematically as

delta G = delta H - T(delta S),

where delta H is the change in enthalpy, T is the absolute temperature, and delta S is the change in entropy. When delta G = 0, the system is in equilibrium and will not change its state. When delta G < 0, the change will be spontaneous. When delta G > 0, the change will be nonspontaneous and require energy input to make it go, or else the reverse direction will be spontaneous. From this equation, it can be seen that it does not take much to go from one state to another. Just a tiny change in delta G will make the difference. The magnitude of delta G does not determine how fast the change will be. It also does not determine how much heat is liberated or taken up. A spontaneous reaction can be endothermic, taking up heat.

These are the most important insights for identifying new cycles. The change in spontaneity can be done by manipulating the temperature or the entropy. GFE controlled phenomena can recover the entropy losses of thermal phenomena without causing the cycle excessive energy penalties. Recycling of thermal energy is possible by maintaining a thermal foundation which is not discarded every cycle.

Here is the sixth reason in support of unity heat engines. The Second Law requires that energy must be added to a system for heat to flow when a system is in thermal equilibrium; therefore, work cannot be extracted from the thermal energy of the air. Such logic also says an airplane cannot get lift from the air because its pressure is equilibriated and must be the same on all boundaries of a fluid by Pascal's principle, and therefore an airfoil will see no net pressure to cause lift. The whole truth is that energy is provided by an airplane's engine to disturb the equilibrium pressure of the air to create lift. Once work is initially produced in an environmental heat-fired engine, which is started by input energy such as a battery, the work generated cools the working fluid to create a heat sink which disturbs the thermal equilibrium of the air. Heat flows from the air and back to the air at the same temperature as work is created and dissipated.

We can find many new energy flow paths if we will just open our minds and think. Science has made great strides in understanding our physical world and predicting the behavior of matter and energy. Let's not get so wrapped up in our achievements that we believe we know it all. Hubris, or false pride, can get in the way. Historically, some prominent scientists have demonstrated this.[5]

By definition, an engine with thermal reference to only its heat source and not to any heat sink is a "perpetual motion machine of the second kind." What can be argued here by skeptics is that the output of this engine could be converted to heat and used as the energy input to sustain itself forever. There is a flaw in this accusation: energy will escape somehow. Escaping energy (radiative losses such as sound, vibration, and infrared radiation predicted by entropy and the Second Law) will not be thermal in nature and will transfer to some other energy sink which will ultimately degrade it to heat. The energy path is nonthermal as it leaves the engine, so its losses will be treated as if the energy losses are totally independent of the surrounding thermal environment, the classical low temperature heat sink. Even if engineers and scientists do accept the argument that a unity engine is not a perpetual motion machine, they may have a hard time accepting the idea that the engine could coast on its own stored energy for a while. Why? Gyroscopes continue to function after their energy sources have been removed. Eventually they coast to a halt. They are not classified as perpetual motion machines. The unity engine is the same. A perpetual motion machine must be at least 100.0% efficient or higher. No such claim is made for the "unity" engine.

There are two mathematical proofs developed by the author for this new thermodynamic heat engine cycle. The first mathematical proof is based upon existing technologies well known and documented in the literature. All thermodynamic states are completely defined. It shows that Carnot can be exceeded. The numbers are easily verified because the technologies are combined in such a way that they do not interfere with each other. Unfortunately, the conditions which allow the synthesis into an engine cycle do not create a practical engine. Carnot dictates a maximum efficiency of 8.2% at the stated working fluid temperatures of the proof. The new cycle is capable of 13.7%, a marked improvement over Carnot. This proof is clear, but raises a debate about the definition of a working fluid. The author's definition of a working fluid is a fluid which does work or has work done on it. It is hard to believe that this definition is attacked to protect old ideas.

The second proof is a theoretical argument which gets around the working fluid argument. It is a parallel to Carnot's theoretical argument under reversible conditions, actually starting from Carnot's argument. With different and clearly understandable assumptions, the proof proceeds to unity efficiency instead of to a temperature ratio. Like the first proof, it is based upon a cycle composed of known technologies, but without complete thermodynamic data. This engine can also be built. It would have a higher efficiency, estimated to be about 70% in an actual engine. This is not an environmental heat engine. It operates just above ambient temperature, like the one in the first proof.

Details of the proofs will be made public at a time when the intellectual property is secure. The proofs are mentioned only so others will know there is more to the concepts than what is reported here. Magnetic Power Incorporated is familiar with the inventions and can vouch for this.[6]

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The lack of working models of these engine concepts is due to the all-too-common dilemma of an inventor: the chronic scarcity of time and money. Money exists where there is commerce. Commerce exists where there are large populations of people. People in general have established beliefs and ways of doing things which are antithetical to the creative process. What money is available is generally not extended to the development of new ideas. Since people generally work for a living, time is only available when money is available, and few of us are financially stable enough to dedicate much of our time and money to our projects. The ability to make lots of money requires being in tune with the majority of people who spend money, and this predisposition is not the alternative perspective so necessary for invention. This is why new ideas so often remain at the idea stage. It is the author's opinion that a necessary ingredient for the success of most new ideas is the philanthropist or the altruistic investor. This is a person who has been in tune with most people and has tapped the wealth of society through commerce, and is broad minded enough to see the need for society to grow. Growth requires change, and change involves risk. The philanthropist or investor often achieved success by taking risks and knows the value of taking risks. For the typical inventor to invest his or her own time and money so necessary for sustenance is not a risk. It is a hazard. Assistance from those who are able is necessary.

1. John R. Howell and Richard 0. Buckius, *Fundamentals of Engineering Thermodynamics*, McGraw-Hill, New York, 1987, p.482.

2. Howell and Buckius, p. 167.

3. Frederick J. Bueche, *Introduction to Physics for Scientists and Engineers*, McGraw-Hill, New York, 1969, p.320.

4. Howell and Buckius, pp. 230-231.

5. Chris Tinsley, "Media Watch," *Infinite Energy*, Vol. 2, No. 8, p.48.

6. Mark Goldes, Magnetic Power Incorporated, Sebastopol, CA (707) 829-9391, fax (707) 829-1002.

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SUPERGRAVITONS AND COLD FUSION

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Introduction

There are millions of patents and millions of scientific papers and many, many books. Indeed, as I see from reading a 1997 issue of *CAM*, the Alumni Magazine of Cambridge in England, over 8 million copies of a scientific book by Stephen Hawking have been sold to readers interested in his *A Brief History of Time*.

All of those copies of that book say the same thing in discussing whether time can run backwards and how time began, as well as whether the universe is infinite or enclosed in boundaries. There is no way of proving what is said on these matters, but 8 million people in the world are avidly interested in such scientific issues. Whether they can understand what the book discloses about the topics just mentioned is questionable, but they can rest assured (by the scientific community) that the content of the book is backed by "reputable evidence," meaning the goodwill of Hawking's fellow researchers who spend their lives delving into the secrets of space-time.

I use the expression "reputable evidence" because I find that this is a criterion applied by the U. S. Patent Office in examining "cold fusion" patent applications. There is, it would seem, no "reputable evidence" supportive of the "cold fusion" phenomenon.

On the one hand there are 8 million books all explaining to the world something that they can never ever understand, far less verify or see as a benefit to their existence, and on the other hand there are millions of patents and millions of scientific papers all saying something different and all being understandable because they have been scrupulously refereed by patent examiners or peer scientists. That is, if you are fortunate enough to have the backing of "reputable evidence," as by being employed in the research laboratories of a major corporation. Yet, we are not destined to see amongst the U. S. collection of patents any which are based on the discovery of "cold fusion," simply because the evidence in support is said to be of no "repute"! It was not "of repute" because it went against the vested interests of those researching "hot fusion" and even though the attempts to prove its feasibility are of more than forty years vintage, that research has the proper "repute."

Why is it that "cold fusion" does not have the backing of "reputable evidence"? The reason is the startling nature of the scientific phenomenon involved. It is basic to the issues involved in the creation of the universe, but "cold fusion" has not developed from the efforts of those who work with big particle accelerators or those who interpret four-space and worry about "Black Holes" and such like. The orchestrated collaboration which keeps universities in funds applied to study the grand issues of the universe by computing what happened in the first few milliseconds after the beginning of time has assured a peer activity in creating the type of "reputable evidence" that Examiner Behrend of the U. S. Patent Office (see *Infinite Energy* Issue #11) would find acceptable .

If *The Wall Street Journal* [Ed. Note: More appropriately, *The New York Times!*] says "cold fusion" is not viable, then Examiner Behrend takes that as reason to reject an application for an invention, the structure of which is new and which has never been considered by those who brief the journalists of *The Wall Street Journal*.

Lack of 2020 Vision at U. S . Patent Office

Now, apart from these opening remarks, I have something more constructive to say and I am going to exercise a little 2020 vision in declaring that, by the year 2020, we will have commercially viable materials that are superconductive at temperatures well above room temperature and which also exhibit ferromagnetic properties. I go further here and ask you to join me in conceiving a new invention by a process of grinding that material down into small particles which are closely moulded inside an electrically insulating substance. That might seem a rather futile thing to do, to take a superconductor and then mould it into a non-conductive block form, but remember that invention ought to have an element of surprise, as otherwise it would be obvious and so non-patentable.

So, in 2020 we find we can make something that ostensibly lacks utility. That is another criterion which Patent Examiner Behrend keeps in mind in judging patentability. But then I say that by doing something obvious we can endow that non-conductive block we have fabricated with 'utility'. It must be useful. Even with our old knowledge of physics we know that a strong magnetic field can destroy the

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superconductive state, but that, once a magnetic field penetrates the superconductor it can become locked into place at a level of field strength below a critical threshold. Our invention is therefore to take that block we have moulded and apply a very powerful magnetic field which we progressively reduce to zero. I then suggest, with my 2020 vision, that we are then left with what is, in effect, a permanent magnet.

If what I say is true, all we need, therefore, is to be patient and wait until we have on the market a material that exhibits superconductive properties at temperatures of the order of the boiling point of water and, hey presto, we can fabricate something new in permanent magnets.

Now, if I were to file a patent application today based on the invention just outlined, the U.S. Patent Office would not grant me a patent unless I could identify a substance suitable for fabricating those magnets. The U. S. patent system does not allow one to speculate, however ingenious the speculation. As a result, the system favours those who confine their efforts to building and testing devices that can be demonstrated with consistent results. The greater issue, such as the prospect of "cold fusion," which may need exhaustive research to unravel all its mysteries, cannot be patented in U.S.A. because Patent Examiner Behrend has to be sure the invention really is a "fusion" device. The idea that a patent can be granted for something meritorious that may need funding and experiment to verify fully its operability is not contemplated. To someone like myself who is familiar with patent practice elsewhere in the world, this simply means that, owing to the trend now set by the cold fusion saga, there will be inventions galore that will never see the light of day in a commercial sense if they originate in U.S.A . and rely on U. S . backing for their development.

Readers of *Infinite Energy* will know that Martin Fleischmann estimates the value of the ultimate breakthrough in "cold fusion" as some 300 trillion dollars. We are, after all, talking about a new source of energy, one which can rival that of the so-called Big Bang creation of the universe, said to be somehow connected with hot fusion. That means temperatures of 100 million degrees rather than the temperatures I contemplate for those magnets fabricated from a new superconductive material.

Coming back to that theme, suppose I think some more about invention and put those grains of superconductor in a tube with no insulating bonding, but there being spaces through which a hydrogen gas can flow over the surface of those grains of superconductor. Suppose I then ask the question, "Might the superconductivity property be enhanced or weakened by the pressure of that hydrogen gas?" Would not that mean that, if I applied a magnetizing field, then a ferromagnetic condition exhibited by the system would respond by developing, as a function of the pressure of that hydrogen, a magnetic polarization coupled with the enormously powerful magnetic fields we associate with permanent magnets? Would not this involve possible hydride formation and heating and cooling as a function of the hydrogen gas pressure and would not that superconductive feature be an important factor in this type of research?

Now, I am going to develop this argument, basing my case on a granted U.S. Patent that has been cited against a "cold fusion" application of mine currently in its examination phase in the U. S. Patent Office.

..... "cold fusion" has not developed from the efforts of those who work with big particle accelerators or those who interpret four-space and worry about "Black Holes"

The subject of that granted patent is the conversion of room temperature heat into electricity. The technique involves the control of hydrogen gas pressure in a cyclic way to produce related variation of the magnetic state of the material. As it switches between a high and low value in unison with the change of pressure, the magnetic field, which is enormous, changes too and it can deliver electricity as output if a coil having many turns is wound around the device.

A little reasoning tells us that the hydride formation is necessarily a surface phenomenon owing to the fairly rapid cycle rate used in the reported experiments. It is governed by the gas pressure and involves cyclic heating and cooling, this being a reversible process, but if we can take power off as the magnetic field goes up and down then we must either be tapping that heat and so cooling the device or. . . well, you, the reader, can tell me where the energy comes from. There is doubt, because the device has to be cooled to get its hydride cycle to run faster. Can it be that the heat cycling is akin to an electrical switch mediating in an energy supply system which only controls action but yet can get a little warm in the process?

Patent Examiner Behrend would expect some "reputable evidence" before granting a U. S. patent having claims to such an invention.

I will identify the U. S. Patent as we proceed, but let me first digress to discuss the "supergraviton."

The Supergraviton

The supergraviton is my own brainchild. It stems from my years of research into the true nature of the force of gravity. It comes into prominence in connection with the neutral Z boson of the high energy particle physicist. But technologically it comes into play in connection with the warm superconductivity phenomenon, and I suspect it also may play a role in the cold fusion scenario.

In this article it is inappropriate to present research ideas that are wholly new. The reader has a right to expect what is described to have matured a little with time and so I will delve into a little history. You see, the years pass by and the research findings of those of us who trespass and express views not in accord with Establishment belief get brushed aside. They are, so to speak, swept under the carpet, but there can come a time when we need to look under that carpet and point the finger of recrimination at those "sweepers."

Like almost everyone in the scientific world, I had not heard of, or contemplated the possibility of, "warm superconductivity" until its discovery, in breaking through the liquid nitrogen barrier, was announced two or so years before we heard of cold fusion. Alex Muller and Georg Bednorz of IBM's Zurich Research Laboratory were awarded the Nobel Prize in 1987 for their discovery.

I spent my main working career with IBM, 19 years of it as their European Patent Operations Director, and visited that Zurich laboratory regularly during those years, years during which my theory of gravitation was evolving as a private venture and had no reason to know that one day my gravitational interest might have bearing on that warm superconductivity phenomenon. I retired from IBM in 1983 and with their support and initial funding became in my retirement a Visiting Senior Research Fellow at the University of Southampton in England, close to my home. My object was to develop my theory by showing it could have technological consequences, the effort being on the electrodynamic issues which I knew were at work in the phenomenon of gravitation. A far cry from superconductivity and cold fusion, you might think, but gravitation is an all- pervading force and there is much to learn.

Having now moved into the latter stages of my retirement I have begun to scan though my published work and it is appropriate to highlight some that is lost in the

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dark corners. It is apt here to reproduce the text of a note I wrote on "The Theory of Anti-Gravity" for BASRA, the *Journal of the British-American Scientific Research Association*, as published in volume XII of the March 1989 issue at pages 2-5.

It was written at a time when those of us interested in these matters sensed a feeling of euphoria because it was understood that advanced project management in British Aerospace was willing to fund an event at Edinburgh University in Scotland under the direction of Professor Salter, an expert on gyroscopic systems, expressly staged to assist inventors in demonstrating their mechanical anti-gravity devices. This was to be an activity conducted behind closed doors until the machines were performing and had been tested, after which there would be a public disclosure at which the press would be present. In the event, however, as seems to be an inevitable circumstance, the show did not take place. Whether this was due to the definition of the test protocol being too stringent or due to intervention by the [Establishment] powers that be or simply due to the lack of readiness by the inventors of these wonderful machines, I cannot say. What I can say is that having been with Scott Strachan when he demonstrated his antigravity machine to an audience of two hundred or so scientists and engineers in Canada in 1988 and knowing that his machine was kept in Edinburgh in a state of readiness for demonstration at the time of the intended event, it is difficult to see why the show did not proceed. Strachan lives about two or three miles from the University laboratory at which Professor Salter was located. The machine, as demonstrated in Canada, developed an out-of balance force sufficient to lift an apple, a tribute to the proverbial discernment of Isaac Newton. Curiously, some years after this event Professor Eric Laithwaite and Alex Jones, in the South of England, both of whom had something to demonstrate, were featured in a television program on the subject. Professor Laithwaite stood on a weighing platform and manually forced his spinning flywheel into its abnormal precessing mode. The professor with his flywheel lost weight, as clearly shown by the measurements conducted in a university laboratory. I can but wonder why this demonstration was not made years earlier at the Edinburgh site, but given Laithwaite's professorial status at the Imperial College of Science, and the fact that he had regularly demonstrated his gyroscopic anomalies at that location, the trek to Scotland to perform for another professor might not have had appeal. Be that as it may, when I wrote the following short paper on "The Theory of Anti-Gravity" for the BASRA Quarterly Journal, I was reacting to the events at the time. The reader will need, therefore, to keep in mind my above comments about the situation as it stood during a winter period in 1988/1989.

The *BASRA* paper reads:

The recent confirmation that a spinning body can lose weight under certain circumstances presents a challenge to those who theorize on the nature of gravitation. The author here explains how his theory of long-standing can cope with this problem.

There are many experimenters who have discovered loss of weight anomalies in spinning bodies. They have been ignored by those established in the system which governs science funding and regulates the teaching of future generations of orthodox scientists. However, the recent confirmation by a specially commissioned commercial testing laboratory that one such device does lose weight has begun to cause rumbles which might well upset the complacent posture of the relativists who monopolize the field.

This is a reference to the machine built by Scotsman Sandy Kidd and tested in Australia, but, as readers know, there are many others who have demonstrated such effects, for example Bruce de Palma in USA, Eric Laithwaite in England, and, as was noted in a recent *BASRA* article [1], Scott Strachan, who demonstrated a machine in Canada in 1988.

There are many experimenters who have discovered loss of weight anomalies in spinning bodies. They have been ignored by those established in the system which governs science funding and regulates the teaching of future generations of orthodox scientists.

A Scottish newspaper, the *Dundee Courier* of 28th December 1988, reported a projected event at Edinburgh University planned just after Easter 1989 at which as many as 12 such machines might be tested before responsible adjudicators with the object of settling this question once and for all.

Now, in the likely event that the phenomenon is verified on this occasion, what will the theorist do to cope with this very troublesome problem? We can guess that those interested in commercial exploitation will be in no such dilemma. Einstein's followers look like being left behind in the advance of technology because their theory is then destroyed for the reasons already of record [1] .

The answer for the non-relativistic theorist is, in this author's opinion, to be found in the theory of gravitation which is of record [2] and which has the following basic features.

Firstly, one needs to admit that space is full of something that has energy but is invisible and very elusive. It is a sea of something having equilibrium to such a degree of perfection that it reveals itself only as a carrier of energy at light speed and, even then, it finds a way of confusing us when we try to detect the reference frame that it provides. We can be sure, however, that it is the seat of an inertial reference frame, since only empty space provides the universal metric in which rotation is measured.

Secondly, one needs to admit that matter, as we know it, exists as a disturbance or misfit in this background sea of energy. Matter exists in some measure related to past events of happenings in this background energy sea, but we need not speculate on that in our quest to understand gravity.

Thirdly, all elements of matter suffer a jitter motion according to Heisenberg's Uncertainty Principle. Matter has mass and is in a state of jitter in the inertial frame. Accordingly, guided by our own experience of how we get things to jitter, we must look for something that provides a counterbalancing action. It is here that the author intuitively made the presumption that some energy is displaced from the local background medium to form concentrated mass quanta (called gravitons) which move in inertial juxtaposition with the jittering matter to keep things in balance.

In summary, therefore, the theory regards a mass M of matter as moving in a pattern of motion constituting what we may term an E frame, which jitters about the inertial frame in which an energy deficit ($-Mc^2$) has occurred accompanying the creation of a graviton mass M in balancing motion in what we may term a G frame.

So far as we can see, the matter mass M stands alone, but jitters. In reality, however, there is a graviton mass M coupled with the matter mass M but neutralized by a mass deficit effect in the sea of empty space.

How does this help us to understand gravity? Well, firstly, we stand a chance of quantifying gravitational action in terms of a standard graviton unit, especially if we say that the real action of gravity is not between matter mass but between graviton mass. Secondly, we can use electrical theory in an interesting way by saying that the electromagnetic reference frame (the

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E frame) is somehow determined by the collective presence of matter mass. This explains why no electromagnetic gravity action is seated in the matter mass. However, because the gravitons move relative to this E frame they are able to assert mutual electromagnetic actions and so give scope for interpreting gravitation as an electromagnetic effect, assuming that the gravitons are electrically charged, pervade a tenuous uniform sea of charge, and come in equal numbers as positive or negative.

Indeed, this theory has developed over the years and the author can now show that the tau lepton is the primary graviton form, whereas the muon lepton forms the background space medium defining the inertial frame. The remaining charged lepton form, the electron, is, of course, a feature of the matter frame or E frame.

What about that demonstrated loss of weight? Well, how can matter mass lose weight if its rest-mass energy is conserved and gravitates, meaning it has weight? It cannot. So the fact that matter mass "appears" to lose weight is clear verification that matter mass has no weight in the first place. It merely can be coupled, and normally is, to graviton mass which does have the right properties. This is what the author's theory is all about. Evidently, by suitable manipulation of flywheels in the reported experiments, that close coupling is severed transiently and sufficiently for the gravitons to begin to fall under gravity when freed from the connection with matter.

In fact, being leptons present in charge pairs, the gravitons die and are recreated constantly by a pair annihilation process. Therefore, as they fall within the coextensive body of the flywheel, they move from positions of higher gravitational potential where they are created closely coupled to matter mass to positions of lower gravitational potential where they decay. This involves energy exchange not sustainable by the vacuum energy equilibrium state if the body of matter itself alters its position relative to the gravitational potential. The reason is that we must have overall energy conservation and if, periodically, the matter mass has its coupling with the gravitons restored, equilibrium demands that any gain of gravitational potential energy in the real matter world must come from somewhere. The laws of mechanics governing the precessing flywheel keep energy conserved so far as concerns motion of the flywheel about axes other than its spin axis. So, unless we can draw on energy of disordered motion, heat energy, the flywheel spin has to yield kinetic energy in some way to meet the demands of gravity, even if this breaches Newton's Third Law of Motion [3] .

The loss of weight by the force-precessed offset gyroscopic machines must, therefore, be accompanied by a slowing down of the flywheels in a levitating system. Conversely, we should expect the flywheels to speed up in a descending situation. Such are the issues now facing researchers in this field. The author's theory of gravitation looks like being able to cope with the gravity challenge now before us.

[1] H. Aspden, *BASRA J.*, pp.2-4, Dec. 1988.

[2] H. Aspden, "Physics Unified," (Sabberton), 1988.

[3] H. Aspden, "Anti-Gravity Electronics," *Electronics and Wireless World*, vol. 95, pp. 29- 31, January 1989.

In the above paper it was stated that only empty space provides the universal metric in which rotation is measured. By this is meant space devoid of matter. It is an experimental fact that a vacuum state enclosed within an evacuated cavity can be the seat of propagating electromagnetic waves which, by their interference, give a measure of the speed of rotation of the enclosing cavity. There has to be something in the vacuum that endows it with a non-rotating frame of reference, something real rather than a notion in a mathematician's mind, and I can but say that this has to be an aether medium.

In referring to Heisenberg's Uncertainty Principle it may seem that I too am building theory on the notions of a mathematician, Heisenberg. I am not, because I see the graviton system and its dynamic balance with matter as the cause of a universal jitter which accounts for that uncertainty relationship. When something jitters in a circular motion and you see it from a distance it might appear to be at rest, but yet at all times its position is uncertain in measure represented by the radius of that orbit and its momentum is uncertain because it reverses direction constantly, but yet the product of the two is a constant which we relate to Planck's action quantum.

Concerning the mention of heat at the end of the paper, I am not really expecting researchers to find that a gyroscope cools when exhibiting anti-gravity. Only experimental research can resolve this question, but if there is an anomalous gain in energy then I have no problem in accepting that it is the aether that cools upon shedding energy. Indeed, the aether heats owing to the gain in entropy and by that jitter motion it puts order into this thermal chaos. When it gets too much energy it sheds it by creating protons and electrons, but maybe the anti-gravity process allows some to be intercepted before reaching the proton stage. The research aimed at 'free energy' is all focused on this same point. We must convert heat into useful power by drawing on the "heat" of our ambient environment or on the "heat" of the underworld of the aether!

Now, this is where the supergraviton enters onto the stage in playing a role as part of the process leading to "warm superconductivity."

How Particle Discovery Reveals a Source of Infinite Energy

In spite of the resources deployed by high energy particle physicists, they still do not understand why Nature creates mesons such as the μ–meson, otherwise known as the heavy electron or muon. Nor do they recognize that elusive ghost, the signature of the graviton, which occurs at 2.587 GeV. This compares with the electron rest-mass energy of 0.000511 GeV, the muon rest-mass energy of 0.106 GeV or the proton rest-mass energy of 0.938 GeV .

However, in 1964, the aether theory I had then worked on for ten years revealed the secrets of the μ-meson and, shortly thereafter, in 1965, the 2.587 GeV graviton emerged. It was then a simple matter to evaluate theoretically the precise value of G, the constant of gravitation, expressed in terms of the electron charge-mass ratio and based on energy perturbations of that graviton form.

At pp. 81-82 of the 1966 edition of my book *The Theory of Gravitation* I show how three well-known mesons were all unstable spin-off products of a decay involving the 2.587 GeV graviton. I also show, from pure theory based on my interpretation of the structured form of the dynamic aether, how its 5063 ratio of mass to that of the electron emerged from the theoretical analysis. By 1969, when I published *Physics without Einstein* I was able to point to the relevance of the discovery, as later reported by Krisch et al [*Physical Review Letters*, **16**, 709 (1966)], of the "largest elementary particle to be discovered." They write: "We believe that this is firm evidence for the existence of a nucleon resonance with mass 3,245±10 MeV . . . It seems remarkable that such a massive particle should be so stable." This nucleon resonance occurred when protons were fed into a high energy environment in which pi-mesons (pions) were being produced. I immediately saw this as a particle resonance in which that graviton ghost had combined with the proton to shed pions and leave the transient signature as the energy quantum discovered by Krisch et

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al. Here was proton decay brought about by that graviton ghost! Note that 2.587 GeV plus 0.938 GeV less 0.279 GeV, the rest-mass of two pions, leaves 3.246 GeV.

Those were the days when particle physicists were probing the scope for creating exotic particles in the energy region we associate with the mass regime of protons, deuterons, and tritons, but nowadays they have gone to the very high energy region where they seek to decipher Nature by discovering particle resonances at mass values akin to those of atoms seated at the middle of the periodic table. This is the region where the supergraviton develops in response to the need for a more effective dynamic balance in that quantum jitter condition of the aether.

My onward research into that territory led me to discover that, if the gravitational balance were to be a joint effort shared by a group of ghost particles, where the mass and charge displacement properties were pooled, then the ratio of these quantities which preserved the G-value would demand a unique supergraviton form as well as a super-heavy electron form (identified as the tau-particle or taon). The supergraviton is the cluster of such a group, but a degenerate form involving the mutual annihilation of a particle pair from this cluster leaves a residual neutral particle resonance in the region of 91-92 GeV, evidently the so-called neutral Z-boson which preoccupies much of the attention of theoretical particle physicists at this time.

The scientific paper disclosing this theory was published in *Speculations in Science and Technology*, 12, 179-186 (1989). The paper is entitled: "The Supergraviton and its Technological Connection." The supergraviton cluster has a rest-mass of 95.18 GeV, corresponding to 102.18 atomic mass units.

As explained in that paper, the technological spin-off had implications for cold fusion, but the key technological contribution was the account of the warm superconductive properties of the perovskite materials Sr_2CuO_4 and La_2CuO_4. These involve a dynamic balance tuned to the near-resonant conditions of interaction with three and four supergraviton masses, respectively. The lanthanum composition has a molecular mass of 405 or 407 according to the Cu isotope present. The strontium composition has a molecular mass of 303 or 305 amu according to the Cu isotope present. This implies an effective supergraviton mass of value between 101 and 102 amu. Warm superconductivity arises because the electron collisions with atoms involve energy transfer from the thermal motion of the atom to the electron, owing to the impact being absorbed through the centre of mass of the dynamic system, whilst field energy stored in magnetic induction sustains the current by its regeneration effect.

This then is some of the background leading to the supergraviton. I have, as I have reported under the title: "Extracting Energy from a Magnet" in *New Energy News*, August 1995, come to realise that the supergraviton is at work in magnetic materials, particularly those exhibiting the very high coercive force needed by a permanent magnet. Indeed, in the latter part of my latest communication to *New Energy News* entitled "The New Energy Spectrum" I drew special attention to the "free energy" implications of a U. S. patent just cited against one of my patent applications. It is U. S. Patent 4,435,663 granted to IBM and dated March 6, 1984. Its title is "Thermochemical Magnetic Generator." What is described is an apparatus which uses hydrogen as a working gas and magnetic intermetallic compounds which absorb hydrogen as the working magnetic material. The description of the invention says that "thermomagnetic generators are devices that convert heat into electricity." The description further shows that hydrogen is not consumed, it is trapped in an enclosure and merely transferred forwards and backwards from one absorbing substance to another cyclically under the regulated control of heat input. The magnetic transitions induce output electricity in a coil wrapped around the chamber housing the working substance. This patent presents experimental data showing that the mere variation of hydrogen gas pressure resulting from the heat cycle will generate electricity. This is a room temperature device but the magnetic state of the intermetallic compound transits through the Curie temperature reversibly, converting ferromagnetic state to non-ferromagnetic state and vice versa, merely in response to hydrogen pressure, as thermally controlled. My interest is aroused by the fact that the chemical composition of the lanthanum pentacobalt working substance varies by absorption of hydrogen and a group of seven or eight such molecules, without the hydrogen, has a mass that is an integral multiple of 101 or 102 amu. The addition of hydrogen in changing $LaCO_5$ to $LaCO_5H_4$ can affect the resonant tuning in the supergraviton coupling.

In my *New Energy News* communication I also mentioned that on March 26, 1997, I was granted GB Patent No. 2,278,491 entitled "Hydrogen Activated Heat Generation Apparatus." It has 18 claims and is part of my, albeit theoretical, efforts to contribute something to the cold fusion theme. I also mentioned that the British Patent Office has notified me that on April 16th the grant of my GB Patent 2,283,361 will be published. This is entitled "Refrigeration and Electric Power Generation." It bears upon the thermoelectric theme, the subject of my *Energy Science Report* No. 3, but it also exploits the 101-102 amu supergraviton resonance theme by disclosing why oxidized polypropylene is a room temperature superconductor and showing how this can be incorporated in a thermoelectric power converter. A group of seven molecules in the chain structure of oxidised polypropylene $[C_3H_6O]_7$ has a molecular mass that is 4 times 101.5 amu.

The IBM patent is, of course, the one which I had in mind in referring to 2020 vision. If you have followed my logic in suggesting invention in using room temperature superconductor materials to fabricate a permanent magnet, then the converse implication is that, with the right treatment, the substances used today in fabricating permanent magnets might prove to be viable room temperature superconductors. The substance lanthanum pentacobalt warrants attention with that thought in mind.

I shall write more extensively on this subject and point to other evidence of anomalous effects arising from hydride (and deuteride) composition resonances as I expand my homepages on Internet. My Internet web page address is:

http: / /ourworld. compuserve. com/homepages/H_ASPDEN

Footnote

Readers who are curious to know where the 2.587 GeV graviton is mentioned in an easily accessible scientific periodical shelved in a university library, may look up the review paper by D. M. Eagles at pp. 265-270 in *International Journal of Theoretical Physics*, **15** (1976). It is entitled: "A Comparison of Results of Various Theories for Four Fundamental Constants of Physics."

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ON TRANSMUTATION

by Graham Toquer

This is a follow up to my previous article (Neutrino Power, *Infinite Energy* Volume 3, No. 13&14, p. 106.) For those who missed that issue, my theory is that the energy generated in the so-called "Cold Fusion"' experiments does not come from fusion, but from neutrinos. Current theories in particle physics allow for extra dimensions, and I speculated that neutrinos exist mainly in a dimension outside normal space/time.

When hydrogen atoms are compressed in the Fleischmann/Pons experiment, I believe that the electron's orbit extends partly into that higher dimension ("N-Space") and interacts with neutrinos (The "Toquer Effect.") I dealt extensively with the subject as it related to the Cold Fusion effort.

Only after submitted my last article did I find out about the transmutation phenomena which are causing such excitement and puzzlement. Considering that I arrived at my theories without that information available, it is most gratifying how well they fit the experimental data.

Transmutation is not entirely new, and I've already touched on it in my previous article. As far back as 1993, cold fusion researchers were finding inexplicable "fusion by-products" in their experiments, such as tritium and helium-4. When the water contained potassium, calcium often turned up in the experiment. This was thought to be the result of the fusion of a potassium atom with a hydrogen atom. I suspect a different kind of reaction.

A neutrino—or anti-neutrino—is essential to the conversion of a proton and an electron to a neutron, or vice versa, It carries the unit of spin which must be conserved, In nature, this conversion is so rare that it takes thousands of gallons of chlorine bleach just to get a measurable result. (The chlorine atom transmutes into argon when one of its neutrons is transmuted into a proton and an electron.)

Neutrinos are generated by fusion reactions in the cores of stars. Inconceivable numbers of them are whizzing past us every moment of our lives. However, instruments designed to measure neutrinos are only finding about a third as many as theory predicts.

I theorized in my previous article that the outer mantle of a star serves as a filter. The atoms of a star's outer shell are so compressed that the Toquer effect takes place, and their electron orbits infringe on N-space. There they can interact with neutrinos. They stop two thirds of them from getting through. It seems reasonable that the higher a neutrino's energy level,the harder it is to stop. In that case, very low energy neutrinos would never escape their parent stars and are not to be observed in nature.

However, in a cold fusion experiment, neutrinos collide with Toquered electrons and lose their kinetic energy. Unlike photons, neutrinos can not cease to exist in this transaction. Neutrinos have spin, and spin is a form of energy which must be conserved. Being so low in energy, the neutrino is now much easier to capture. And the same electron which stopped the neutrino is compressed up against an atomic nucleus containing protons.

If the electron is orbiting an atom of protium hydrogen, the electron plus the neutrino plus the proton will yield a slow neutron and a positron. The neutron can be absorbed by any nucleus that will accept it. Packing nuclei with neutrons will eventually make them unstable, and they will fission.

If this reaction is taking place, the positron will then be attracted to the nearest electron and they will annihilate each other and yield gamma rays. In an experiment involving nuclear waste, that might not be noticeable against the natural radiation already present. But if anyone out there has a transmutation experiment going that does not involve radioisotopes, they might want to check for gamma bursts. More about that later.

Alternatively, an anti-neutrino, once stopped, can cause a neutron to turn into proton and an electron. If this takes place inside a larger nucleus, it will transmute into something else. In many cases, the new isotope created will not be stable, and will fission, usually by ejecting protons or beta particles (identical to helium nuclei.)

This does not tell the whole story, however. The kind of reactions described should produce a lot of radioactive isotopes, and exactly the opposite has been observed. The Cincinnati Group made a sample of radioactive thorium turn into titanium and copper. The process we are dealing with seems to specialize in causing radioactive isotopes to decay, not in creating new ones. I think I see why.

Up to now, I have described the Toquer effect in terms of an electron's orbit around a nucleus. That orbit is a function of the electron's "Matter wave" which must conserve. Squeeze that orbit too tightly, and the wave has to go somewhere, so it pokes into N-Space and meets up with neutrinos.

However, all particles act as both particles and waves. By definition, a radioactive nucleus is one in which the protons and neutrons are crammed together very tightly. In such a case, the matter wave of a nucleon could also be compressed into N-space. Then it could meet up with a neutrino, and transform, making the nucleus unstable and causing fission. I strongly suspect that the Toquer effect is involved in all fission reactions. In essence, the Toquer effect is the so called weak interaction which governs neutron breakdown.

When a large number of protons and neutrons are combined into a nucleus, the mass of the nucleus is slightly less than the combined masses of the nucleons. The excess was radiated away as photons in the course of the nucleus's formation, and must be returned in order to fission the nucleus. Just how much energy is missing in this fashion is the "packing fraction." The packing fraction is greatest in the middle of the periodic table. Iron-56 is the most stable nucleus of all, for that reason.

All nuclear reactions tend toward lower energy levels inside nuclei. Lighter nuclei will absorb nucleons until they get to the middle of the periodic table, because this lowers their energy state. Larger nuclei will decay until they get to the middle of the table. Such large nuclei were originally created in supernova explosions, the only place where it could happen.

Note that this process involves only nuclei whose nucleons are Toquered, the radioactive ones. It selectively eliminates those nuclei only, which is in keeping with The Cincinnati Group's observations.

Free neutrons have a half life of about twelve minutes before breaking down into protons and electrons, even though neutrons in nuclei are stable. I think I know why. A nucleon in a nucleus is in the grip of the strong interaction. An electron orbiting a nucleus is in the grip of the electromagnetic interaction. Both these interactions keep a particle firmly glued to our three-dimensional universe, except when their matter waves are compressed. But a free neutron has no such encumbrance. It is free to be even more wavelike, more indeterminate in its position in space and time. And sooner or later—say, twelve minutes—it will infringe on N-space, meet with a neutrino and break down. Free protons will not exhibit this behavior. They can not transform without either absorbing an electron which is not available, or emitting a positron.

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which would violate the law of conservation of energy.

Natural radioactive decay occurs on the rare occasions when a nucleon catches a high energy neutrino. Normally, such a capture of a neutrino is very rare because natural neutrinos are high-energy. But in a cold fusion experiment, there are lots of low energy neutrinos available. They readily combine with nucleons in overcrowded ("Toquered") nuclei and cause particle transformations.

Obviously, large nuclei such as thorium will decay into smaller nuclei. At the lower end of the scale, I suspect that potassium turns into calcium by first absorbing a neutron and becoming "Toquered," and then having one of its neutrons turn back into a proton when it meets up with a neutrino. This would require less energy than fusion with a proton.

One of the results from The Cincinnati Group's experiment was that the titanium created had an isotope ratio out of proportion to that which occurs in nature. This might suggest that free neutrons are indeed being created out of protium atoms. Isotopes which are low in neutrons would absorb them. This would continue until isotopes which were overloaded with them would break down. Any radioactive fission products would also be transformed or fissioned in turn. The end result would tend toward those isotopes with the greatest packing fractions.

There are a couple of easy ways to check this hypothesis. One is to check for gamma ray bursts in a transmutation experiment. The other is to bring a sample of any radioactive material next to any working cold fusion experiment. If my hypothesis is correct, the abundance of low energy neutrinos should accelerate the rate of radioactive decay and cause a noticeable increase in radiation output.

Transmutation may not be quite the bonanza you were all dreaming about. The potential for getting rid of atomic waste is still there. Unfortunately, it's not so promising for transmuting lead into gold, or anything like that. [**Editor's Note: Don't be so sure! Stay tuned for more "golden developments"!—EFM**] At the upper end of the periodic table, this process moves downward in atomic number. If you want gold, you need to start with something like Uranium. Transmuting heavy elements upward in atomic number would be far more complicated, and is probably years away.

And when it comes to building production-model neutrino energy taps, transmutation will actually be a serious engineering problem that must be overcome. We will have to rely heavily on those elements least likely to transmute, perhaps even using selected isotopes. We'll obtain them by the same diffusion processes used to prepare isotopes for atom bombs. (What delicious irony!)

This effect may even pose a serious pollution problem. If low energy neutrinos are not used up inside a neutrino tap, conceivably they could interact with unstable isotopes in the surrounding environment and increase the level of background radiation. If neutrino power pushes out all other sources of energy, this could be a real problem.

But then again, if we could generate enough low energy neutrinos, we might be able to speed up the decay of the fallout from Chernobyl and make the region habitable and fertile again. We might be able to return Bikini Atoll to its former residents, and decontaminate old fission reactors so that they can be safely scrapped.

The most immediate concern is that this phenomenon lends considerable support to my theory, and I hope that the cold fusion researchers reading this article will sit up and take notice. As always, I hereby cede all of the foregoing to the public domain.

Do it—please!

Write a letter about cold fusion and new energy to your Congressman, Senator, President, favorite Candidate, or Prime Minister.
THEN—Send it to *IE*—

upside down—even more so than already.

When one tries to examine the situation objectively, is it really any more astonishing that gold can be produced from lead than that uranium or thorium can be drastically reduced to lighter elements in minutes or hours by the CETI or Cincinnati Group processes? Both achievements are unqualified "miracles"—in the context of established physics and chemistry. The gold making just happens to coincide with an ancient and oft-repeated claim of "adepts" throughout history. This is a subject that we will revisit in future issues of *Infinite Energy*—we have been wondering about this for a long time. Perhaps it was (*and may still be!*) that many of these adepts actually accomplished what they said they had done—and were held closely by protective monarchs or secretive governments. Today we have even high-school students entering the fray! Here is a description of an apparently successful precious metals "enhancement" experiment done this year (from Joe Champion's www site):

Wednesday, February 5, 1997

16 Year Old Replicates TAMU Experiment
by Joe Champion
Update by Dan York

The science fair experiment is a replication of one of the transmutation experiments performed at Texas A&M University in 1992. Joe Champion gave Dr. Bockris at TAMU the protocols to perform the transmutation experiments. Dr. Bockris then brought in Dr. Roberto Monti to do the hands-on work.

The series of experiments conducted at TAMU were designated as "Thermal 0" thru "Thermal XVI". The experiment replicated was designated as "Thermal II". The ingredients used in this experiment were: 300 g Carbon (C); 900 g Potassium Nitrate (KNO_3); 80 g Sulfur (S); 100 g Iron Sulphate ($FeSO_4$); 30 g Cadmium (Cd); 100 g Mercury Chloride, ($HgCl_2$); 50 g Litharge (PbO); 5 g Silver (Ag); 30 g; Calcium Oxide (CaO). **[WARNING: This experiment is very dangerous— do NOT do this without expert supervision.—EFM]**

The ingredients were thoroughly mixed and placed in a 3lb. coffee can and ignited with a torch.

Dr. Barry Merriman was present through the entire experiment and has validated the results. Barry has provided the student a signed statement attesting to the fact that the amount of silver increased from 5 grams to 8.7 grams and that there was a small amount of gold produced.

Dr. Roberto Monti has also provided a signed statement verifying two additional fire assays that were done on the residue material a few weeks following the initial experimental burn. The results of these fire assays were essentially the same as those done by Barry, but showing slightly more silver.

An XRF on the burned material was done by Mr. Bill Stehl, which also verified the presence of gold as well as some iridium. A mass spectrometry analysis has also been done on the before and after material. This was just completed yesterday so there has not been time to complete an analysis of the result.

One major problem the student faces is the fact that her science teacher was a student at TAMU. She is aware of the 1992 experiments but not the true results. Because of the political situation at the TAMU campus instead of the actual results being reported, the students and faculty were informed that there were no positive results at all.

Joe Champion has posted a transcription of the lab notes for the entire series of thermal burns conducted at TAMU in 1992. You can get to them from his WEB page at www.transmutation.com/tamu.htm. Partial results of the original experiments were also presented at the first and second Low Energy Nuclear Reactions Conference at College Station.

In an attempt to satisfy the requirements of a Science Fair, a 16 year old female High School student from Dallas, Texas undertook the replication of an experiment conducted at Texas A&M University in 1992 by Dr. John O'M Bockris under the direction of Joe Champion. The outcome of the experiment was validated by four observers, inclusive of a research scientist from a prestigious university in California. The observing scientist (nameless until publication) has attested to the authenticity of the following: an unusual phenomena occurred, for only 5.0 grams of Ag was placed into the original matrix of the thermal burn and the total combined precious metals observed at the end of the experiment was greater than 8.7 gram, and the ending material has a significant presence of gold, whereas the starting material was confirmed by myself to be void. The results were determined by the physical collection of the ending precious metals using standard metallurgical techniques.

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Morphologic Deformation and Distribution of Generated Elements in Saturated Palladium Samples Processed by a UV Excimer Laser

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PACS. 13.75-Nucleon-nucleon interactions
PACS. 29.25-Neutron sources
PACS. 81.40-Treatment effects on microstructure and properties of materials
PACS 98.80.F-Formation of elements

Abstract

This work reports on the experimental results obtained from saturated palladium hydrides processed by a XeCl excimer laser. This process provided a screening effect of 14.2 when it was applied to deuterated palladium samples. They presented a low neutron emission and a strong tendency to release particles when were perturbed by O_2. The samples processed showed morphologic changes with formation of pits and superficial stresses. Besides, the transmutation of many elements, Al, Au, C, Ca, Cl, Fe, K, Mg, Na, Nd, Ni, O, S, Si, V and Zn, was recorded. By the Pd cross-section analysis the Fe and O distributions inside the palladium have marked.

1. Introduction

Since the Fleischmann and Pons, and Jones et al. experiments were announced[1,2], many cold fusion experiments have been performed all over the world utilizing different systems. Several experiments reported the generation of amounts of heat using heavy water in electrochemical cells. Other experiments, using molten salt, reported an excess power at least 600% over the input power.[3] Cold fusion reactions have also been observed by electrolysis in light water[4,5] with an excess energy.

The fusion reactions involving the deuterium and hydrogen atoms and providing excess heat are the following:

$$D + D = {}^3He(0.8\ MeV) + n(2.5\ MeV)$$
$$D + D = T(1.0\ MeV) + p(3\ MeV)$$
$$D + D = {}^4He + \gamma(23.8\ MeV)$$
$$p + p = D + e^+ + \nu(1.442\ MeV)$$
$$p + p + e^- = D + \nu(1.442\ MeV)$$

To explain the results of the excess heat the Coulomb barrier between two deuterons within the octahedral cage of crystalline palladium was studied.[6] It was found that the repulsive forces were always higher than the corresponding forces between deuterons in molecular D_2.

A interesting theoretical work studied the boson tendency to clump deuterons in palladium[7] and it found that the attractive force supplied kinetic energy to deuterons moving toward the center of the cluster, and for a cluster that included 24 deuterons the results gave good fit to the experimental values published by Fleischmann et al.[1]

Then, to understand the involved processes it was very important to control the D concentration within the Pd crystal and to find a technique for improving the rate of the phenomenon.

From the power law[8] and from Jones' results[2] the minimum distance between the nuclei for nuclear reaction is about 3 pm [picometer]. Besides, the minimum distance d for hot fusion reactions for central collision is calculated by:

$$d = (1/S)^2 1.43\times10^{-11}/E \qquad (1)$$

with d is the distance measured in cm and E is the energy between the deuterons given in units of 10 keV. The interaction time of fusion is:

$$U=8.139\times10^4 d^{34.8} \qquad (2)$$

where d is the minimum distance between the deuterons at fusion, measured in pm.

Assuming that the deuterium atoms within the palladium host crystal essentially are freely moving as classical plasma particles[9], the localization process of the deuterium inside the palladium could decrease the time for fusion reactions due to the screening factor increase. Clusters can be more easily realized by forming layers on the host sample which localize gas atoms inside the palladium. To reach this aim, a new technique, used for direct silicon nitridation, was proposed which consisted of cells containing gas and UV laser irradiation.[10] The deuterium layers were formed by means of the plasma created near the palladium surface as a result of direct laser irradiation of the target in deuterium atmospheres. An XeCl laser with wavelength of 308 nm and a photon energy of 4.02 eV was suitable to dissociate deuterium or hydrogen atoms, via multi-photon processes.

The process causes the deformation of palladium and the transmutation of elements Al, Au, C, Ca, Cl, Fe, K, Mg, Na, Nd, Ni, O, S, Si, V and Zn as well as anomalous concentration of the atoms or molecules particularly of mass number 1, 2, 3 and 4. By the Pd cross-section analysis the Fe and O distributions inside the palladium were marked

II. Experimental setup

In this experiment five stainless steel chambers of different dimensions were used, which allowed us to perform more experiments at the same time. Each chamber was equipped with a quartz window at its end. A locally built XeCl excimer laser (308 nm) provided the UV beam for the irradiation. Its characteristics have been described previously.[11] It is formed by two discharging regions utilizing two capacitor charge transfer type circuits with nominal primary and secondary capacitance of 60 and 25 nF, respectively. The output laser beam was 2 x 1 cm centered between the electrodes of 100 mJ, 20 ns (FWHM) pulse duration and 5 mrad divergence. The laser beam was led into the cells by a 30 cm focal length lens, as can be seen from Fig.1. A palladium wire was coiled and placed at the inner part of the chamber and supported by two small brass supports. The laser beam was focused into the chamber with the focus position very near to the palladium, with an energy density of 0.5 J/cm^2 and 2 Hz repetition rate. The laser beam did not produce sparks in the gas and did not provoke plasma on any metallic wall.

The neutron emission was measured with a Victoreen Neutron Survey Meter 488A and with CR-39 polycarbonate detectors. An Ametek quadrupole gas analyzer MA100 was used in order to measure the residual particles present in the gas chambers. During the gas analysis the chamber containing the palladium was connected to a turbo-molecular vacuum system. After the experiments, the Pd

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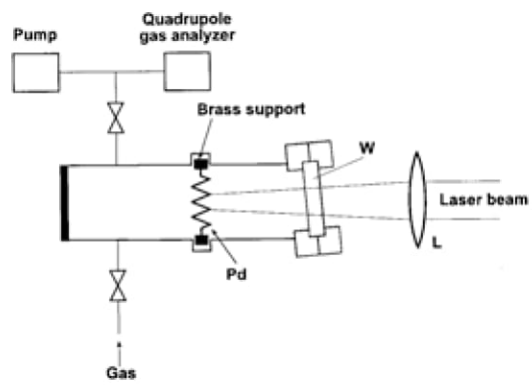

Fig. 1 Experimental setup. Pd: palladium sample, W: quartz window, L: 30 cm focal length lens.

wires were analyzed by a scanning electron microscope (SEM) and an electron probe microanalyzer (EPMA) which detected the atoms present on the targets.

III. Experiment results and discussion

The experiments were performed with a palladium wire of 13 cm long and 1 mm in diameter in deuterium or hydrogen atmospheres. When the chamber was filled up to 2310 mbar deuterium, after a few days the pressure dropped at the beginning of the loading process. After D_2-loading for 30 days the atomic concentration D/Pd was about 0.77 and the palladium came into contact with air by opening the chambers. In this phase the temperature only increased by less than 5°C.

After a day, the chamber was refilled again with deuterium at 2310 mbar and successively the palladium was irradiated with the laser beam of about 0.5 J/cm^2 for 60 min/day at a repetition rate of 2 Hz, forming layers on the sample surfaces which localized the absorbed gas inside the palladium crystal. After D_2-localizing for 30 days the chambers were opened and some palladium samples became incandescent for about 30s reaching a maximum temperature of 850°C.

When a new palladium sample (not-soaked) was placed inside the chamber with deuterium at 2310 mbar and successively the laser beam was applied, the total pressure did not change sensitively and after 20 days the total pressure only fell down of a few mbar. This behavior can be explained by assuming that the laser action that favored the layer formation did not allow the deuterium to come inside the palladium. The maximum temperature value reached in these experiments remains very interesting, as well as the role of the air. However, similar behaviors were observed by Ray et al.[12] when their cathode came in contact with air and the temperature increased only tens of degrees. A temperatures of about 475°C were found in experiments with D_2-loaded nickel samples but with a 50 W heater power input.[13]

Experiments with less than 30 loading days and less than 30 localizing days were performed and in this case the palladium did not become incandescent. When the loaded palladium with D_2 for 30 days was not in contact with air but the chamber only was refilled with D_2 up to 2310 mbar and successively the laser beam action was applied for 30 days, no Pd-incandescence was observed when the chamber was opened.

Other experiments were performed with 35 loading days, 1 day in contact with air, and 35 localizing days. In this case small explosions were observed when the chamber was opened. Several experiments were also performed with much more than 35 loading days and much more than 35 localizing days and only some palladium samples exploded when they came in contact with air.

The residual gas contained in the non-exploded palladium was analyzed by the quadrupole gas analyzer MA100. The chamber gas was pumped down to 10^{-7} bar by a turbo-molecular pump and its residual gas was successively analyzed. Fig. 2 shows the analysis of the residual gas after the run of an exploded sample. It is possible to observe the presence of particles of mass number 1, 2, 3, 4, 20 and 21.

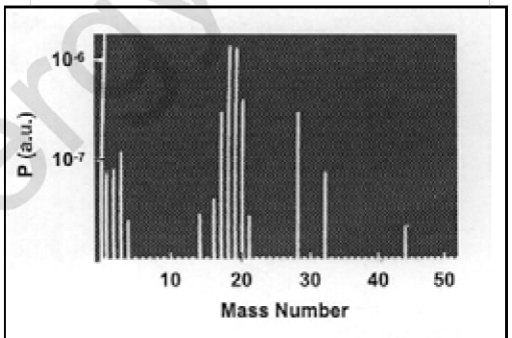

Fig. 2 Mass spectrometer results of the residual gas contained in the exploded palladium sample with D localized.

In order to understand the influence of the air, the residual gas of the Pd samples was analyzed after contact with only oxygen. Namely, 1-bar oxygen was put into the chamber containing the same Pd sample, and after one-hour the gas was analyzed and many particles were found to be present. The percentages of the particles with mass number 3 and 4 were higher than the percentage of the mass number 1 and 2, see Fig. 3. This result could contribute to understand the results of Ref. 12, where the authors found that the oxygen plays a vital role in the experiment. The O likely reacted with the deuterium present on the palladium surface, causing the particles present inside the target to come out.

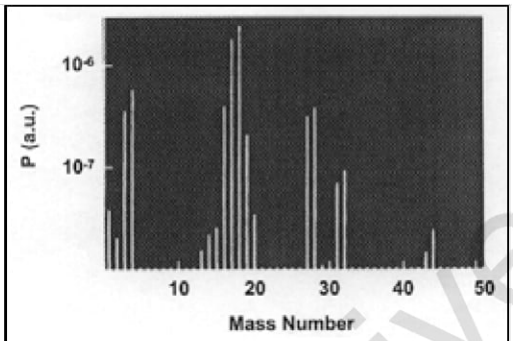

Fig. 3 Mass spectrometer results of the residual gas contained into the palladium with D_2 localized after one hour of contamination by O_2.

Different values of emitted neutron were found from chambers having palladium loaded with D_2 (#1), from chambers having palladium with D_2 localized by layers (#2) and from chambers having only 2310 mbar of D_2 without palladium (#3). These measurements were performed during the night in order to reduce the noise influence due to electromagnetic irradiation of laser discharges during the day. Each chamber was tested many times (>6). The average counts were:

#1 21.96 ± 0.48 neutrons/hour
(Chambers having D_2-loaded palladium)

#2 22.56 ± 0.79 neutrons/hour
(Chambers having D_2-localized palladium)

#3 20.76 ± 0.73 neutrons/hour
(Chamber having only 2.31 bar D_2)

Although the low count values, there was a difference among the three cases. By considering the experimental set up and the Victoreen neutron meter position, the total neutron emission from targets is 20 times higher than the measured values. However, even if the neutron flux was very low and statistically small meaningful the average values obtained were different and the value of the experiment #3 was supposed to be due to the ambient neutrons. In this experiment the total ambient neutrons was not investigated as well as their energy. The value measured in the experiment #2 seems to be higher of about 1.80 ± 1.52 n/h than the value measure in the experiment #3, and the total neutron flux was estimated:

$$A = 430 \times 10^{-3} \text{ n/s}$$

This result can be ascribed to the screening effect which favored the tunnel process

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through the Coulomb barrier.[8] In fact, considering the total deuterium atoms absorbed, $D_i = 5.23 \times 10^{21}$, the classical collision frequency for deuterons was:

$$f = 1.4 \times 10^{-8}\, n_i / T^{3/2} = 1.75 \times 10^{17} s^{-1} \quad (2)$$

where n_i (5.23×10^{22} cm^{-3}) is the deuteron density and T the temperature measured in eV. The probability for a fusion reaction[14] at the above frequency is $A/fD_i = 4.7 \times 10^{-40}$. This value is 34 times higher than the D-D fusion rate per second for D2 molecules.[2] By the Boltzmann expression:

$$\exp(-E/KT) \quad (3)$$

the above probability is reached at a room temperature of 0.026 eV with deuteron energy of 2.35 eV. From Eq. (1) the minimum distance for central collision of 3 pm is reached for energy of 476 eV. This result can be explained considering the screening factor, namely the distance d is modified to

$$d = (1/S)^2\, 1.43 \times 10^{-11} / E \quad (4)$$

Therefore, by Eq. (4) a screening factor S = 14.2 was reached due to the layers formed on the palladium surface.

The lower neutron emission measured from loaded palladium, #1, (1.16x20 n/h) could be explained by the absence of layers that did not localize the deuterium atoms inside the palladium.

The layer formation might contribute also to increase the plasmon energy in the Preparata's plasmon model increasing the fusion reaction rate[15]. Other experiments were performed utilizing CR-39 polycarbonate detectors to investigate the neutron generation. In this case three chamber were used containing only D_2(##1), D_2-loaded palladium(##2), and D_2-localized palladium(##3). In each chamber two CR-39 were placed inside. After 30 days the detectors were developed and analyzed and the results were:

Chamber (##1), A = 1 tracks/mm
Chamber (##2), B = 1.2 tracks/mm
Chamber (##3), D = 1.5 tracks/mm

However, the difference in the density of the measured tracks between the three chambers was meaningful. It indicates that about 0.5 neutrons/mm^2 per month were detected by the CR-39 surface.

No incandescent phenomena as well as no neutron emission were observed when the experiments were performed with hydrogen gas instead of deuterium.

All processed palladium samples that did not explode were analyzed with the SEM and the electron probe. By this investigation either the samples processed with D_2 or the samples processed with H_2 showed modifications of their surfaces. The deuterated samples showed in particular many pits and stress. Figs. 4a and b show two SEM images of the deformed palladium. Aiming the electron probe on the pit many elements were recorded. Fig 5 shows the spectrum of the elements with Al, C, Ca, Fe, Mg, Na, O, while the Fig. 6 shows the spectrum of virgin palladium. Transmutations of elements in solid cathodes but in experiments with liquid electrochemistry recently has been observed.[16]

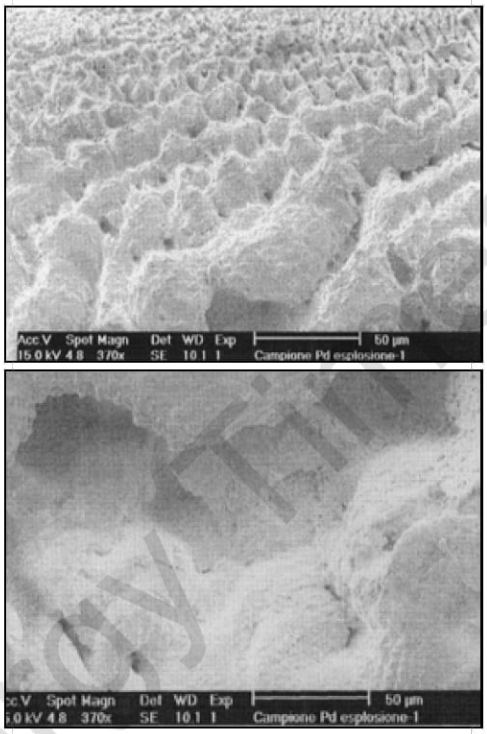

Fig. 4 Two SEM micrographs of D_2 processed palladium. a) sample showing small pits and stress; b) sample showing a large pit.

In this experiment the transmutation of elements in gas loading samples was observed. The transmutation of elements was also observed on the windows utilized to seal the cells. Because more windows during the experiments were broken, it will seem useful to analyzed their surface by the SEM and EPMA. From all these analysis the generated elements were: Al, Au, C, Ca, Cl, Fe, K, Mg, Na, Nd, Ni, O, S, Si, V and Zn. During these experiments the contamination of the samples was avoided.

Another investigation was the analysis of the inside of the palladium. Then, it was cut and its surface was analyzed by the EPMA, aiming only to get the concentration of Fe and O. The map shown in Fig. 7b, is the result of the Fe and O concentration of the palladium shown in Fig 7a. In Fig 7b the Fe is evidenced with the blue color while the O with the yellow color. [*Editor's Note: Not colored in the illustration on these black and white pages.*] One can see that the O is distributed almost uniformly while the Fe is concentrated in the lower part of the pit.

Theories are in progress to explain the formation of new elements present within the first angstroms of the Pd surface.

IV. Concluding remarks

In this work new phenomena during cold fusion experiments have been observed using an excimer laser. The layers formed by laser action introduced a screening factor which reduced the Coulomb repulsion. The most singular phenomenon was the incandescence of the palladium and the transmutation of elements in gas loading instead of liquid electrochemistry. The new elements found were: Al, Au, C, Ca, Cl, Fe, K, Mg, Na, Nd, Ni, O, S, Si, V and Zn.

V. Acknowledgments

The author would like to thank A. Castellano and O. Civolani for the useful discussions, and Dr. F.M. De Riccardis, Dr. M. Re and Dr P. Creti for the SEM, EPMA and photo analysis, respectively.

VI. References

1. M. Fleischmann and S. Pons, "Electrochemically Inducted Nuclear Fusion of Deuterium" *J. Electroanal. Chem.* 261, 301 (1989)
2. S. Jones, E. Palmer, J.Czirr, D. Decker, G. Jensen, J. Thorne, S. Taylor, and J. Rafelskii, "Observation of Cold Nuclear Fusion in Condensed Matte,." *Nature* 338, 737 (1989).
3. B.Y. Liaw, P.L. Tao and B.E. Liebert, "Recent Progress on Cold Fusion Research Using Molten Salt Techniques," *Proc. 2nd annual Conf. on Cold Fusion*, Como Italy, June 29-July 4, p.55, Italian Physics Society (1991).
4. R. Mills and K. Kneizys, "Excess Heat Production by the Electrolys of an Aqueous Potassium Carbonate Electrolyte and the Implications for Cold Fusion," *Fusion Technology* 20, 65 (1991).
5. R. Notoya, "Cold Fusion by Electrolysis in a Light Water-Potassium Carbonate Solution with a Nickel Electrode," *Fusion Technol.* 24, 202 (1993).
6. C.T. White, B.I. Dunlap, D.W. Brenner, R.C. Mowrey, and J.W. Mintmire, "Limits of Chemical Effects on Cold Fusion," *J. Fusion Energy* 9, 363 (1990).
7. K.I. Tsuchiya, K. Ohashi, M. Fukuchi, "A possible mechanism for nuclear reaction in solids," *Fusion Technol.* 27, 452 (1995).
8. H. Hora, J.C. Kelly, J.U. Patel and M.A. Prelas, "Screening in Cold Fusion Derived from D-D Reactions," *Phys. Lett. A* 175, 138 (1993).
9. H. Hora, L. Cicchitelli, G.H. Miley, M. Ragheb, A. Scharmann and W. Scheid, "Plasma and Surface Tension Model for Explaining the Surface Effect of Tritium Generation at Cold Fusion," *Il Nuovo Cimento D* 12, 393 (1990).
10. T. Sugii, T. Ito and H. Ishikawa, "Excimer laser enhanced nitridation of silicon substrates," *Appl. Phys. Lett.* 45, 966 (1984)
11. V. Nassisi and M.R. Perrone, "Double XeCl laser with Lateral UV Preionization" *Appl. Phys.* B51, 254 (1990).
12. M.K.S. Ray, R.D. Saini, D. Das, G. Gattopadhyay, R. Parthasarathy, S.P. Garg, R. Venkataramani, B.K. Sen, T.S. Iyengar, K.K. Kutty, D.N. Wagh, H.N. Bajpai and C.S.P. Iyer, "The Fleischmann-Pons Phenomenon a Different Perspective," *Fusion Technol.* 22, 395 (1992).

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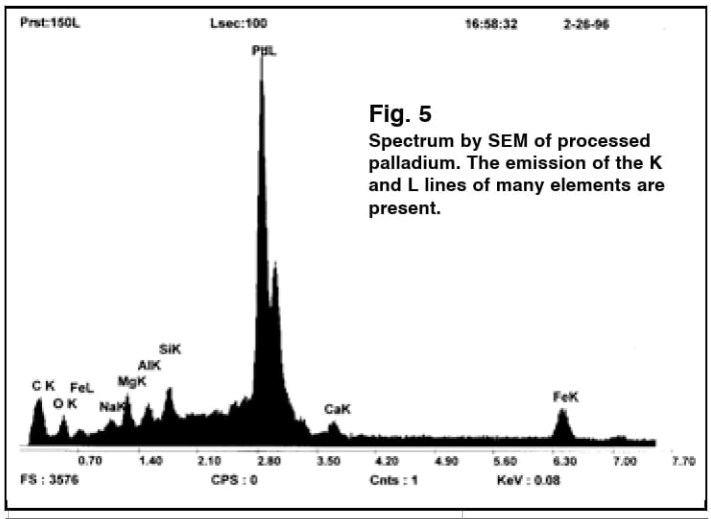

Fig. 5
Spectrum by SEM of processed palladium. The emission of the K and L lines of many elements are present.

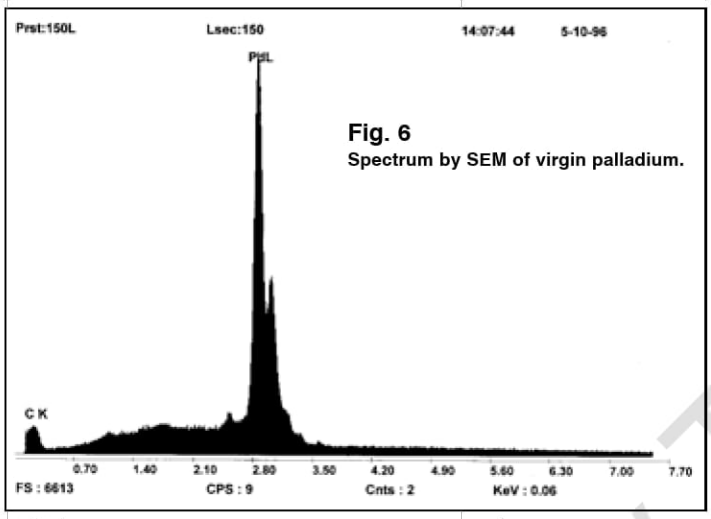

Fig. 6
Spectrum by SEM of virgin palladium.

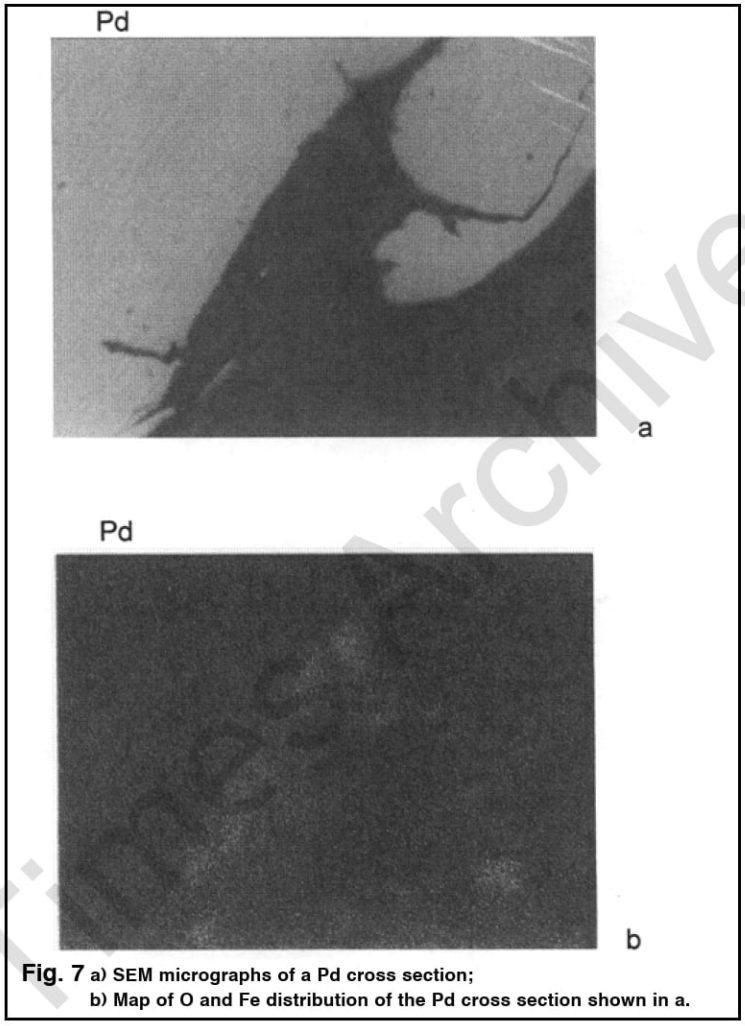

Fig. 7 **a) SEM micrographs of a Pd cross section;**
b) Map of O and Fe distribution of the Pd cross section shown in a.

(1992).
13. S. Focardi, R. Habel and F. Piantelli, "Anomalous Heat Production in Ni-H Systems," *Il Nuovo Cimento* 107 A, 163 (1994).
14. H. Hora, "Plasma at High Temperature and Density" Springer Berlin, (1991).
15. G. Preparata, "Some Theory of Cold Nuclear Fusion: A Review" *Fusion Technol.* 20, 82 (1991).
16. J.O. Bockris and Z. Minevski, "Two zones of impurities observed after prolonged electrolysis of deuterium on palladium," *Infinite Energy* 1, 67 (1997).

Christopher Tinsley (1943-1997) in His Own Words....
(through 1992 when he joined up with Gene and Jed)

Christopher Paulsen Tinsley, born l943, England

Married, two children born 1971, 1973.

Educated at Ratcliffe College, Leicester, 1955-61
Usual '0' levels (eleven total, including English, French, Latin)
'A' level Maths, Physics, Chemistry
'S' level Physics, Chemistry.

Downing College, Cambridge University, 1961-63, Natural Sciences Tripos.
Left before taking degree.

1964-1981 ICL and its predecessors (initially English Electric Computers):

1964-65 (Kidsgrove, Staffs) mainframe commissioning and field support. Spent much spare time on writing diagnostic software to help with the job.
1965-69 (Kidsgrove) design and development of in-house automatic test systems, with especial emphasis on software. Headed small team.
l969-71 (Central London and Heathrow) Manufacturing division representative to the LACES (Heathrow multi-terminal, multi-mainframe Customs Cargo Entry system).
1971-78 (Kidsgrove) Headed team to develop multi-access test system for complete printed circuit logic assemblies. Designed and implemented operating system to allow IBM 360 compatible mainframe to drive special testers and associated display terminals.
1978-81 (West Gorton, Manchester). Responsible for design quality of the S3K (Estriel) mainframe.
Left ICL under voluntary redundancy scheme. Final salary about 10.8K [£]

1981-83 Marconi Radar Systems, Chelmsford. Design manager on part of Martello national defence radar system. Not happy at all with certain aspects of corporate policy. Left February 1983, final salary about 12K[£], no particularly useful technical experience apart from X25 communications protocols.

1983-92 Plessey Telecommunications (latterly GPT), Beeston, Nottinghamshire. Software Manager, working usually heading a small team sometimes alone. Redundant 1992.

Much involved with IBM PCs and compatibles from the days of DOS 1.1, (when we had to justify 64kb of RAM!) most software written in assembler (Intel or Microsoft) and latterly in Microsoft 'C'. Frequently working very close to the hardware, and at detailed levels within DOS itself. Implemented BIOSs, voice processing and communications software, but also worked at the user interface level to write applications. A little recent work with Windows 3.0. Final salary 23K [£]

Particular strengths are the ability to solve the most difficult software and hardware/software interaction problems, and to be able to carry a project from conception, to customer support, alone or with assistance as appropriate.

Having moved so often, I should prefer to work within driving distance of Nottingham and not to work for G.E.C. or any of its subsidiaries.

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Unusual Reactions of Mass 5 with Helium and Catalytic Metals

by Ronald J. Kovac, M.S.
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5169 Clarkson, Denver, CO 80216

ABSTRACT

It is shown that pieces of sheet gold or platinum when exposed to excited nitrogen from a low pressure ring discharge or a capillary plasma discharge, visibly glow or melt. Associated historical experiments are cited, dating from 1884 to 1955, concerning excess heat and afterglow. The case is then made that this form of nitrogen is really mass 5 as reported at the First Conference on Low Energy Nuclear Reactions held at Texas A&M University in June 1995. All 100 years of scientific anomalies discovered in the name of activated nitrogen can now be resolved as the physical, chemical, and atomic electrodynamic nature of atomic mass 5. New research using mass spectroscopy has shown that when mass 5 is exposed to helium, reactions occur causing the entire range of masses to appear —off-scale from 3 amu to 100 emu. The associated pressure increase is sometimes so great as to cause the mass spectrometer to trip "auto shut down" to prevent damage to the mass spec.

INTRODUCTION

In Vol.1, No.1. 1996 of the *Journal of New Energy* p.87, it was reported that the missing mass emu= 5 was created in a rarefied nitrogen quartz plasma tube surrounded by opposing magnetic fields. It was also reported that the same mass 5 could be obtained by squeezing the nitrogen plasma through a pyrex glass frit comprised of capillary tubes. The results are duplicated here as Figures 1 and 2. Fig. 2 is from Texas A&M results of reheating one of the quartz tubes used. All the results are mass spectrometer examination of the mass 5 over a range of time of 6 seconds to 6 hours (Texas A&M plot). [9],[10]

Mass 5 was first discovered in May 1994 using opposing field plasma tubes and a capillary glass frit plasma tube.

Nitrogen was the parent gas at low pressure inside each plasma tube, Figs. 3 and 4. A literature search on nitrogen plasma proved a windfall. Early researchers, Warburg [1], Dewar [2], Rayleigh [3] Strutt [4], Mita[7], and Stanley[5] researched "activated nitrogen" from 1888 to 1955. Their work was with a gas that was created in a similar way to the method depicted in Figs. 3 and 4. The gas would glow after the current was turned off for as much as 8 hours. They found that gold or platinum in the gas would get heated and sometimes visibly hot and melt. Many other anomalies were found as well as a good emission spec-

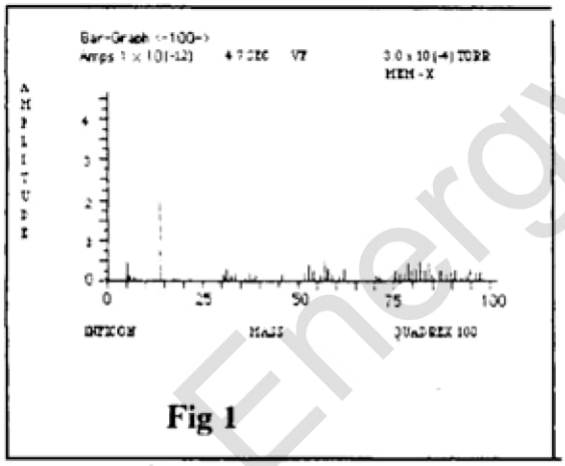


Fig 1

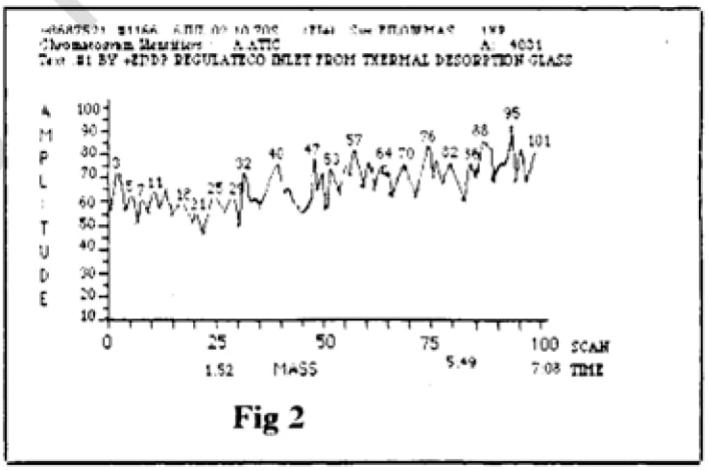
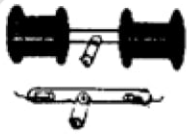


Fig 2



SEP. 1994 RON KOVAC, MASS 5 CREATED
IN QUARTZ TUBE WITH 2 OPPOSING MAGNETS
(one year later Weiman & Cornell freeze atom into a wave, confirmed bu M.I.T. using the same opposing magnetic fields).
This confirms the Bose/Einstein condensate theory.

Fig. 3

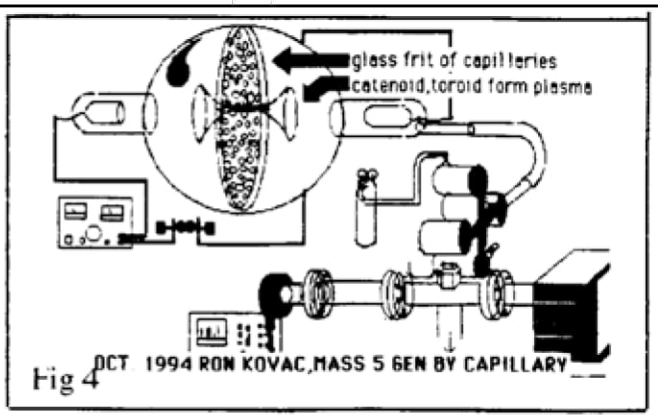


Fig 4

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troscopy spectrum, but the nature of the gas remained an unresolved mystery. Fig. 5 is the apparatus that was used to show that mass 5 is the real identity of "activated nitrogen, " which is no longer nitrogen.

APPARATUS DESCRIPTION

Glassware and power supplies were designed to repeat the "activated nitrogen" experiments of the past and still allow mass spectrometry and emission spectrometry to prove it is no longer nitrogen, but mass 5.

HISTORY OF ACTIVATED NITROGEN (HENCEFORTH MASS 5)

WARBURG (1884,) and later DEWAR (1888) noticed that some types of spark discharges in a rarified nitrogen atmosphere would create a plasma, but when the power was turned off, the gas would glow. LEWIS (1900) first identified the unusual green, yellow, and red band spectra.[9]

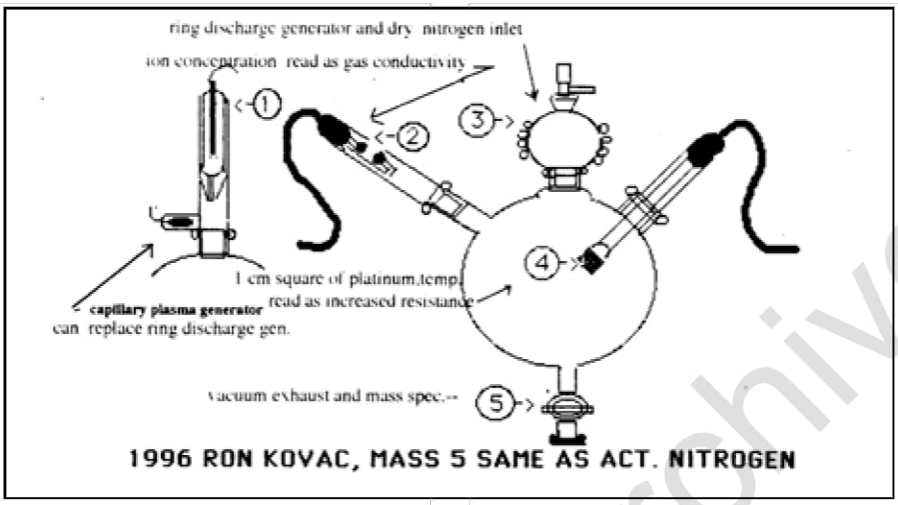
STRUTT (1911) used apparatus such as in Fig. 7 to investigate strange chemical reactions with mercury, phosphorus, and many other elements. Reviewing his results, Strutt wrote, "It seems doubtful if the current atomic or molecular composition of chemistry will suffice to describe these results." RAYLEIGH (1911) identified spectral bands for activated nitrogen at 6252, 5804, 5407, and 5054, but if oxygen was present a different afterglow would appear at 5485, 5870, 5592,and 5248 nm. Strutt pointed out that the reaction was one of nitric oxide and activated nitrogen creating the peroxide by emission spec. He also pointed out that this in itself was an anomaly. How could activated nitrogen and nitric oxide give a substance not less, but more oxidized than itself? RAYLEIGH (1935) discovered that a sulfuric acid coating inside the vessel would prolong the after-glow to 8 hours by getting rid of the least amount of water.[5]

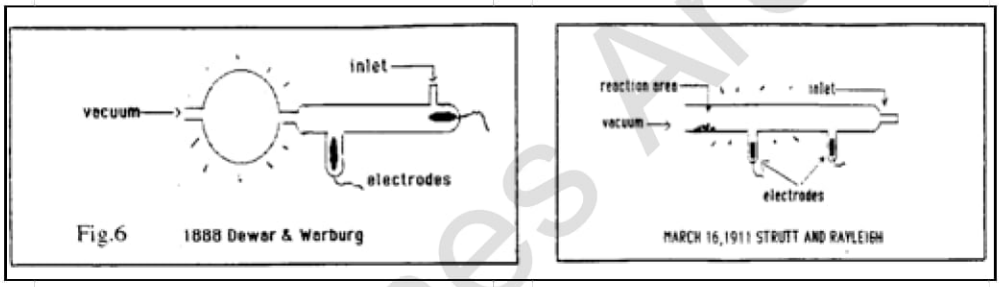
In 1935 Rayleigh studied luminosity versus pressure and temperature for reaction rate information with which to model a molecular reaction. The results were contradictory for pressure and temperature. Strutt found that the after-glow ion concentration (as measured by conductivity) was not related to the afterglow intensity and decay. This meant the ion recombination model was invalid. The most surprising anomaly was found by Rayleigh in (1935) when a piece of gold got red hot when inside the gas, Fig. 9.[6].

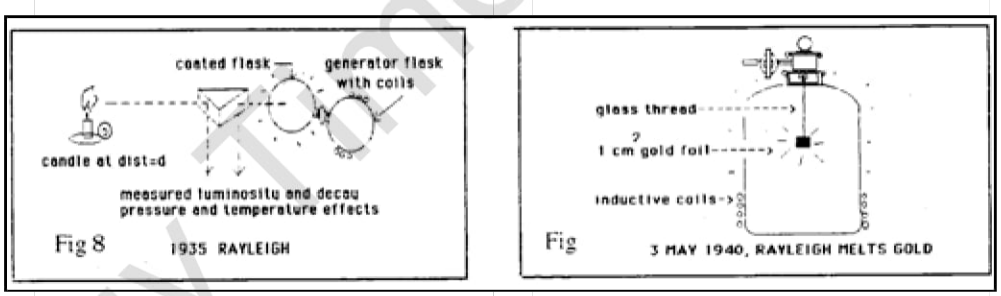
Many designs of experimental set ups were tried by Rayleigh in the following five years to accurately measure what appeared to be more energy put out as heat from the platinum or gold metal in the gas than could be explained even if every molecule gave up it's ionizing energy to the metal. The energy was found to be as high as 10 ev for every N_2 molecule and the after-glow was one-thousandth of the energy collected by the metal. Later, in 1946, Rayleigh measured energies as high as 223 ev/molecule. This was done using the apparatus shown in Fig. 10.

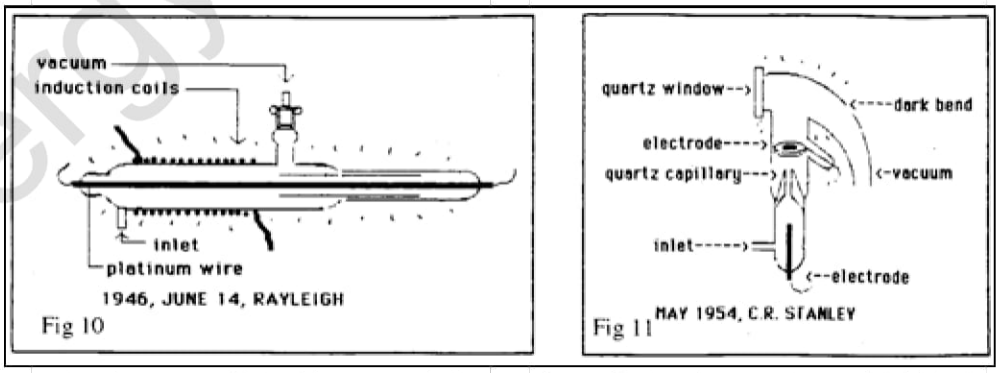
Rayleigh on 14 June 1946 finally created the energy measuring plasma tube of Fig. 10. With this apparatus he concluded, "The great liberation of energy much exceeds what can be explained by dissociation of molecules and single ionization of every atom, which would only afford 36 ev, not 223 ev/molecule, as observed." This is reflected in the explosive nature of He reacting in the author's mass spec. with mass 5, as will be discussed after this historical profile.

Stanley, in May 1954, found another way to create activated nitrogen using an electrode inside a capillary tube causing the plasma to go through the capillary. This is shown in Fig. 11. It is very close to the same design that was used to create mass 5 as in Fig 4. Stanley attempted to model a bi-molecular energy explanation by modifying earlier work done by Mitra in 1953.[7] Both models looked as though they agreed









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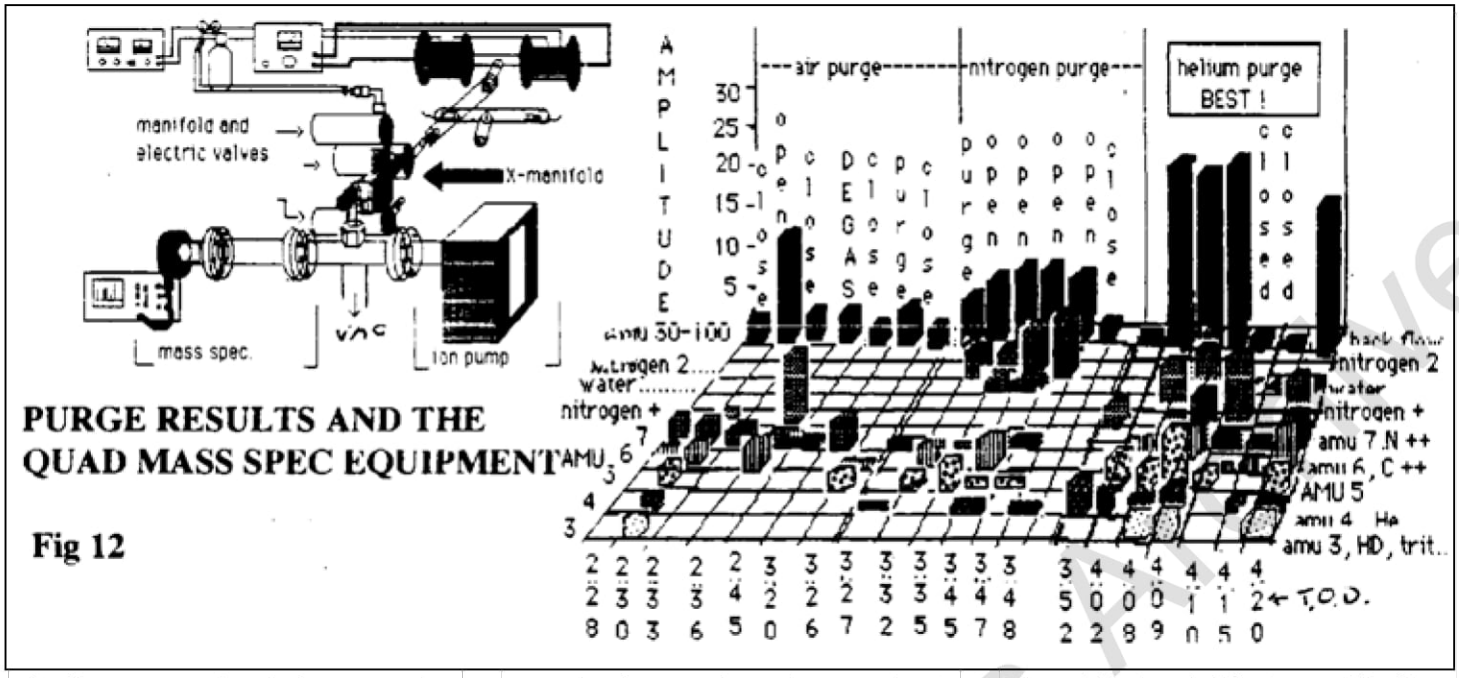

PURGE RESULTS AND THE QUAD MASS SPEC EQUIPMENT

Fig 12

with the very good emission spec. data from the Fig.11 apparatus, but neither model could explain 223 ev/molecule energy.[8]

UNUSUAL REACTIONS OF MASS 5 WITH HELIUM

When the manifold and line were to be purged and cleaned in preparation for new experiments, several gases were tried. Mass 5 was not easy to clean out of the vacuum system until He was tried. The mass spec. manifold full of accumulated mass 5 and the purging results of air,nitrogen, and helium are in Figure 12.

When the helium was introduced for purging, 16 times out of 16 purges (every time) the explosive behavior of the reaction would generate a plot such as in Appendix A, Figure A, or the pressure increase would trip the auto shut down of the mass spectrometer to prevent damage. Between purges, the valve was shut for one minute and a control spectrum was plotted to show that the mass spectrometer was still calibrated and functioning properly. These control plots had very little mass from back flow etc. showing. The helium would fill every mass from amu = 6 or less to 100 amu— all off scale quantity, every time it reacted with residual mass 5, until finally there was no more mass 5 with which to react.

CONCLUSION

A windfall of chemical, physical, and electromagnetic information characterizing mass 5 is available from the literature under the subject, "activated nitrogen," since this work shows activated nitrogen is mass 5. This very strongly supports the hypothesis that the missing mass 5 has been created and it is a consequence of special plasma dynamics previously described and published.

ACKNOWLEDGMENTS

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REFERENCES

1. Warburg, E., 1884 *Arch. Sci.* Geneve (3), 12, 504.
2. *Roy. Inst. Proc.*, 1888
3. *Proc. Roy. Soc.*, A Vol 86, p.266 (1911)
4. Strutt, R.S., 1913 *Proc. Roy. Soc.*, A, 88,539-549.
5. Rayleigh, 1935 *Proc. Roy. Soc.*, A, 151-567-584.
6. Rayleigh: 1940 a *Proc. Roy. Soc.*, A 176 1., 16.
7. Mitra.S.K.. 1953,*Phys. Rev.*, 90, 516.
8. Stanley, C.R., *Proc. Phys. Soc.* LXVII, 9-A, May 1954.
9. Kovac, R.J., *Journal of New Energy*, Vol. 1, No. 1, 1996 p.87
10. Kovac, R.J. *Extraordinary Science* Vol. VIII, issue 1, 1996.1SSN 1043-3716 pp.22-37

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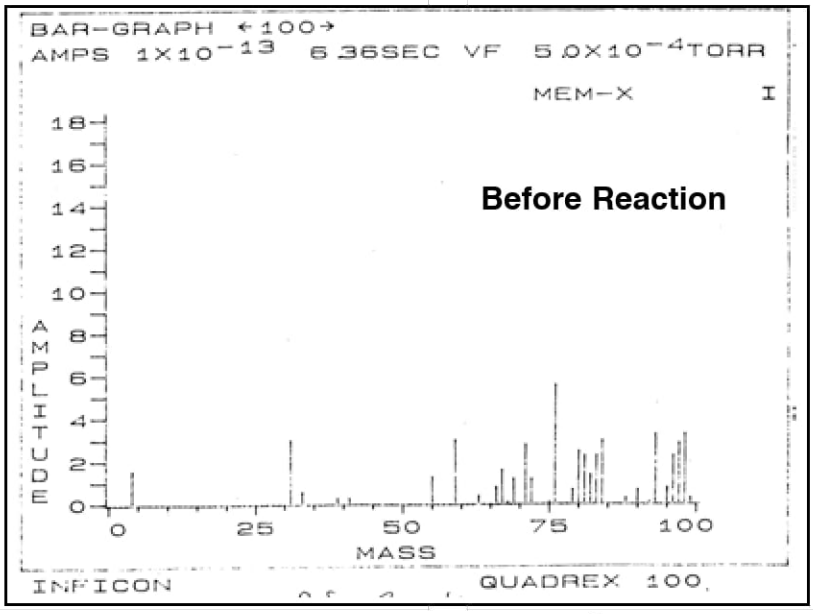
Appendix: Mass Spectrographs Before, During, and After Mass 5 / Helium Reaction

If the mass assortment created consists of molecules and not ion clusters, it would explain why the helium given off by volcanoes reacts with mass 5 generated by lightning to make helium rare in our atmosphere and mass 5 non-existent. Recall that Mass 5 reacts with Oxygen and water.



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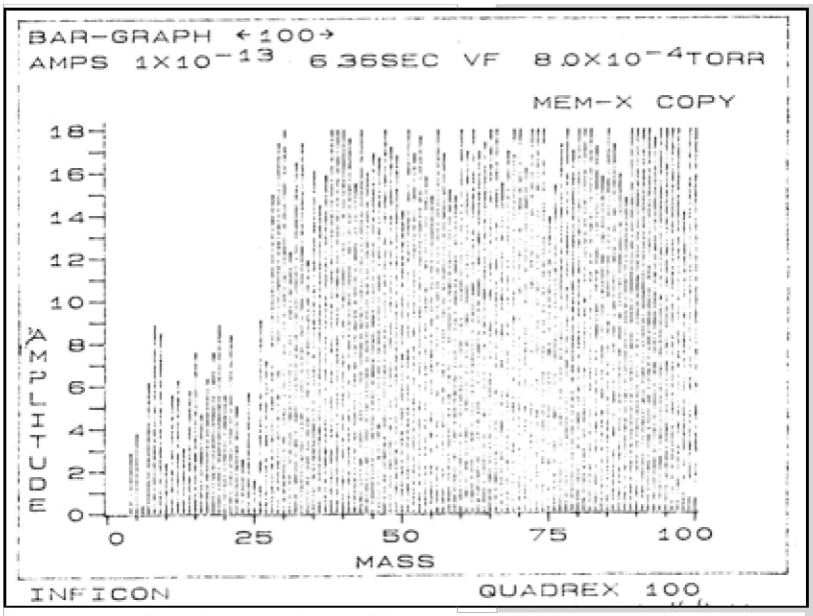
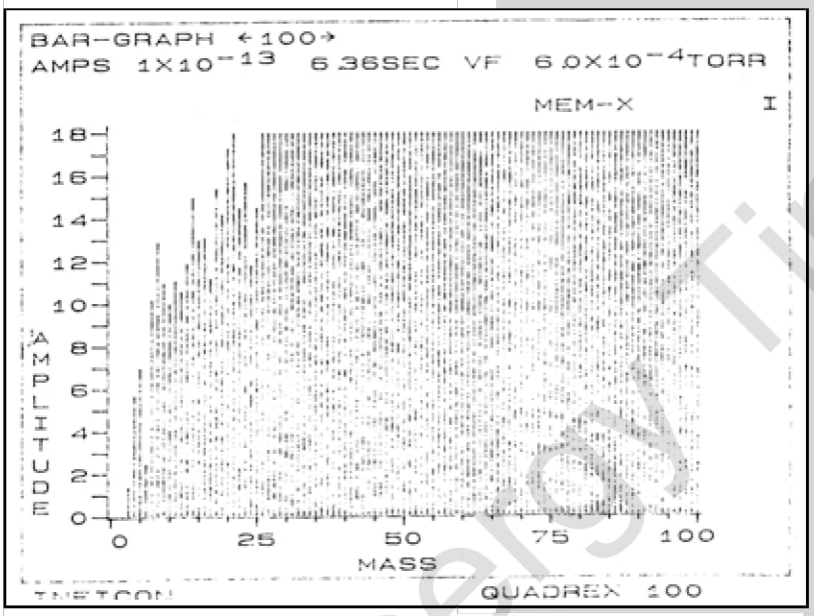
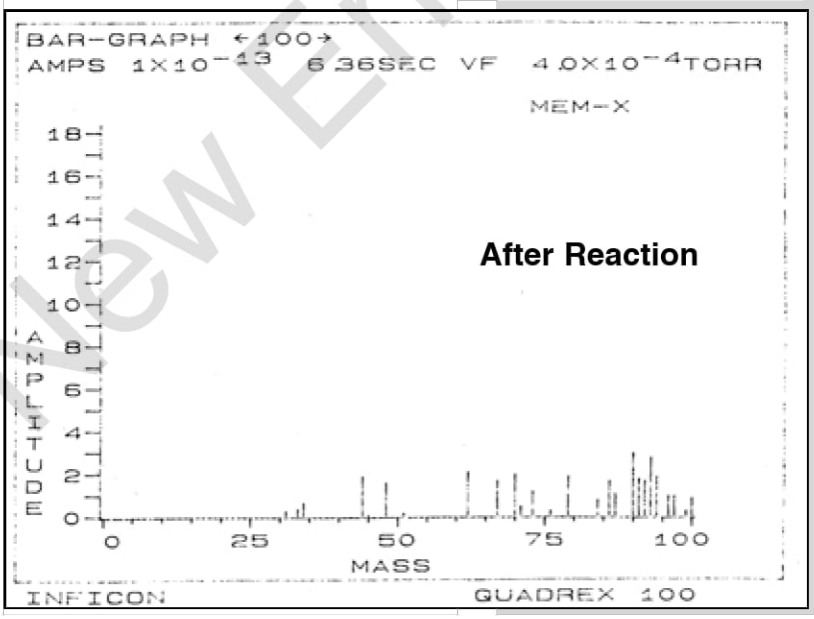
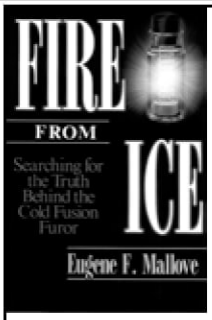


During Reaction—Mass 5 + Helium



During Reaction—Mass 5 + Helium





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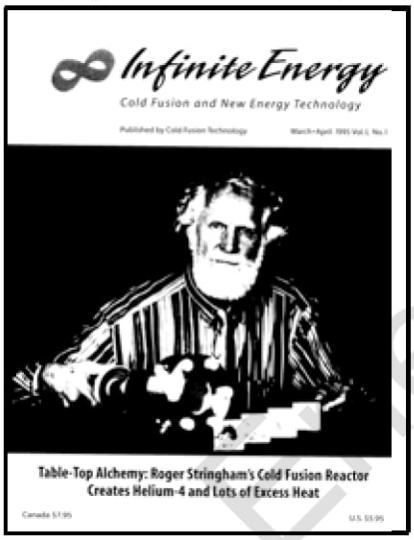

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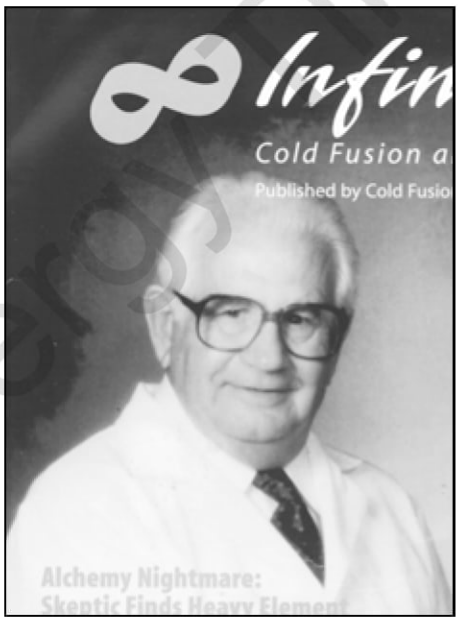

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